Advant® OCS
with Master software

Electrical Diagram Builder
Building Libraries
Version 3.0/1

User’s Guide

3BDS001710R0101

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Chapter 1 Introduction

1.1 Before You Begin

This book describes rules and guidelines relevant for building libraries, i.e. drawing formats, symbols and typicals using the drawings functions of Electrical Diagram Builder. This book is not intended to describe the functions of Electrical Diagram Builder in detail. For a description of the drawing functions consult the Electrical Diagram Builder User's Guide and the *el*Master design User's Manual.

1.2 Equipment Requirements

For a description of the system requirements consult the Release Notes of AdvaBuild Engineering Workplace and the Release Notes of the Electrical Diagram Builder.

1.3 How to Use This Book

This book is organized into chapters and sections as shown in Figure 1-1.

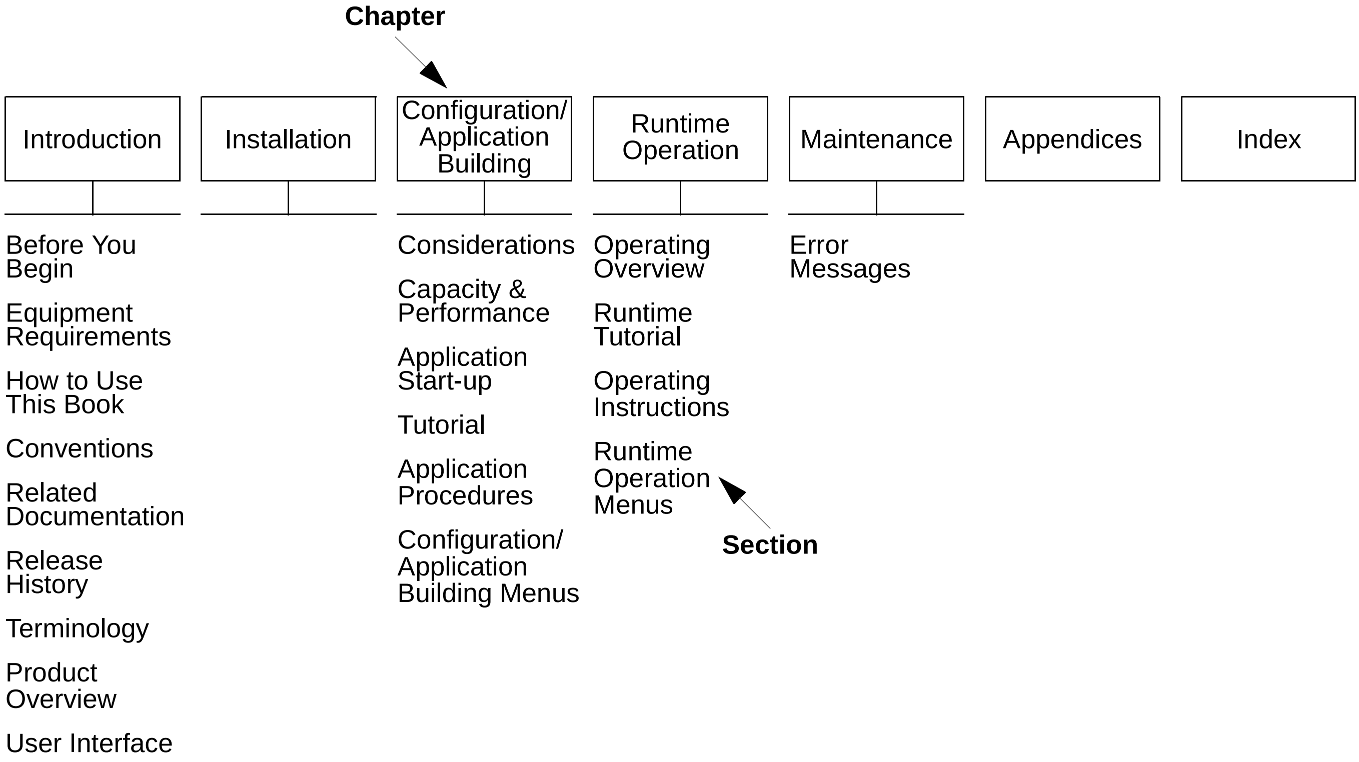


Figure 1-1. Organization of Manual

The main part of this users guide is placed in the Appendices. Here you will find the rules and guidelines for each topic in a separate appendix as shown in Figure 1-2.

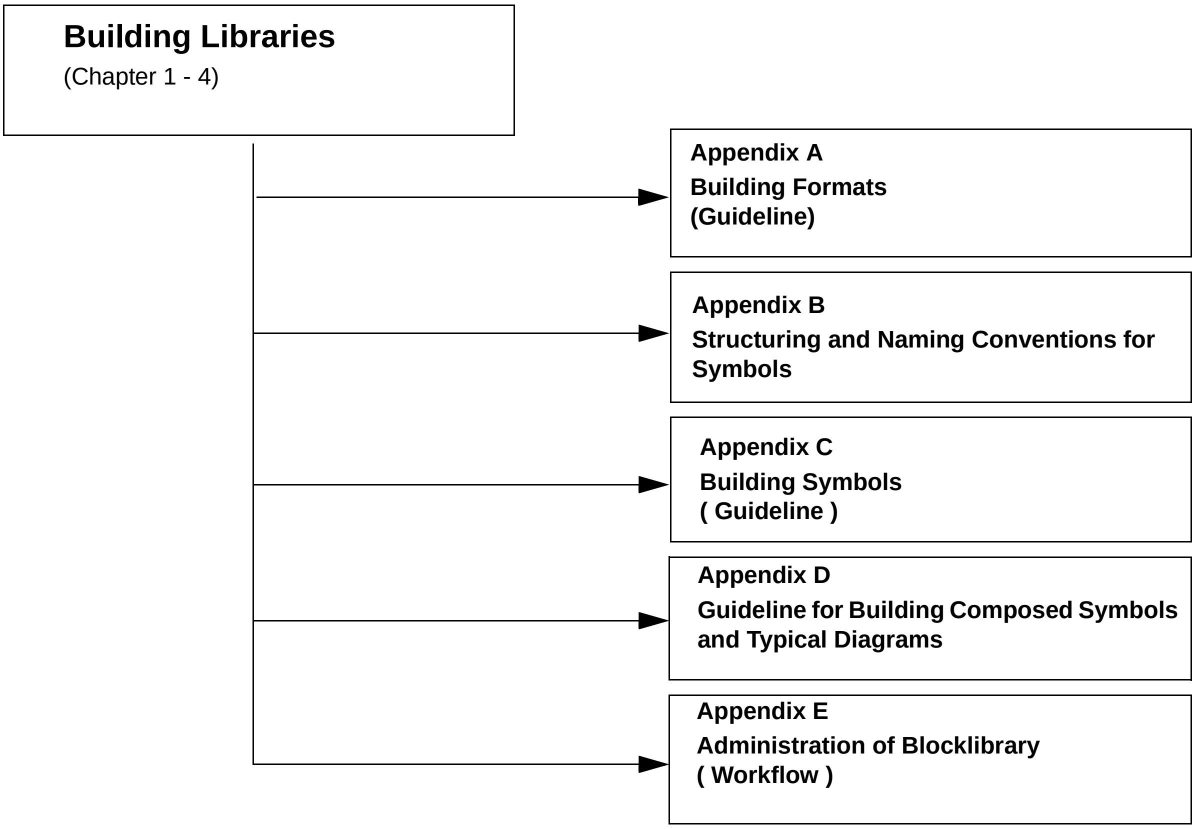


Figure 1-2. Organization of the Appendices

1.4 Conventions

Keyboard interaction

When you read	You shall
File | Copy	Open the **File** menu, choose the item **Copy**, and click it with left mouse button
Ctrl+M	Press the **Ctrl** key and the key labelled **M** simultaneously

1.5 Related Documentation

Table 1-1. Related Documentation

Title	Description
Structure Builder User’s Guide	Describes how to create projects, Advant objects, structures and aspects and how to navigate in projects
Wiring Builder User’s Guide	Describes how to handle wiring data, i.e. wires and cables assigned to physical connections between devices
Electrical Diagram Builder User’s Guide	Describes how to handle electrical aspects of Advant objects
elMaster design User’s Manual	Describes how to create circuit diagrams using symbol and format libraries
elMaster project User’s Manual	Describes how to create structures, objects and assign articles to objects
elMaster project administrator User’s Manual	Describes how to perform administrative tasks on the database like, e.g. create and maintain article libraries, edit system variables and configuration parameters

.

Table 1-2. National and International Standards

Ref.no.	Document Identity	Document Title
[I1]	CEI/IEC 1082	Preparation of documents in electrotechnology -1: General requirement -2: Function oriented diagrams
[I2]	IEC 617-1..13	Graphical symbols for diagrams
[I3]	IEC/SC3B(Sec)92	Standard character set to be used in electrotechnical drawing
[I4]	IEC/SC3B(Sec) 130	Addition to IEC 1082-1 "Additional rules for simplification techniques of item designations"
[I5]	IEC/SC3B (Sec)122	Structuring Principles and Reference Designations
[I6]	IEC 750 Edition 1983	Item designation in electrotechnology
[I7]	IEC 3B(Sec) 100	Preparation of documentation for plants, system and equipments
[S1]	ISO 3098	Technical Product Documentation -10: General requirements -11: CAD-lettering of Latin alphabet, ciphers and markers
[S2]	ISO 3511-1/2/3/4:	Process measurement control functions and instrumentation
[S3]	ISO 5457	Technical drawings - sizes and layout of drawing sheets
[S4]	ISO 7200	Technical drawings - Title blocks
[S5]	ISO/IEC 11714	Design of graphical symbols for use in technical documentation of products Part 1: Basic rules Part 2: Specification of graphical symbols in computer sensible form.....
[S6]	IEC/3A(Sec)307	Graphical symbols for diagrams, Part 1: General rules, general index
[S7]	ISO/DIS 10 628	Flow diagrams for process plants Part1: General rules
[S8]	ISO 8859-1...9	Information processing; 8-bit single-byte code graphic character sets
[S9]	ISO/IEC 10303-212	Electrotechnical plants, External Representation of Product Definition Data

Table 1-2. National and International Standards

Ref.no.	Document Identity	Document Title
[S10]	ISO 1291	Fluid power systems and components - 1: Graphic symbols - 2: Circuit diagrams
[D1]	DIN 32 830	Graphical Symbols, Rules for creation of graphical symbols for use in technical documentation
[D2]	DIN 40 719	Diagrams, charts, tables T1: Definitions and classifications T2: Item designations T3: Recommendations for the preparation of circuit diagrams T1000: (Draft) Rules for computer-aided design of electrotechnical circuit diagrams
[D3]	DIN 6776 T1	Technische Zeichnungen, Beschriftung Schriftzeichen
[D4]	DIN V 6779	Structuring principles for technical products and technical product documentation -1: Basic rules and principles -2: Tables for identification letters
[D5]	DIN 19227	Control technology, Graphical symbols and identifying letters for process control engineering 1: Symbolic representation for functions 2: Representation of details
[D6]	DIN V 40900 T1000	Graphical symbols for diagrams; Rules for computer-aided construction of graphical symbols
[D7]	DIN 28004	Flowsheets and diagrams of process plants - 1: Definitions - 2: Drawing Instructions - 3: Graphical symbols
[D8]		ECAD Bauteilenorm
[A1]	Basic B6 (92-8)	ABB Corporate Standard: Drawing Rules
[A2]	B19 (93-05)	ABB Corporate Standard: Documentation of Deliveries Kind of Documents
[A3]	B20 (93-05)	ABB Corporate Standard: Documentation of Deliveries General Principles

1.6 Release History

Table 1-3. Release History

Version	Description
3.0/0	Initial Release of Electrical Diagram Builder EDIB on the Windows NT platform
3.0/1	Revision of the Electrical Diagram Builder to be compatible with Advant Engineering Workplace 1.1

1.7 Terminology

The following is a list of terms associated with … that you should be familiar with.

Term	Description

1.8 Product Overview

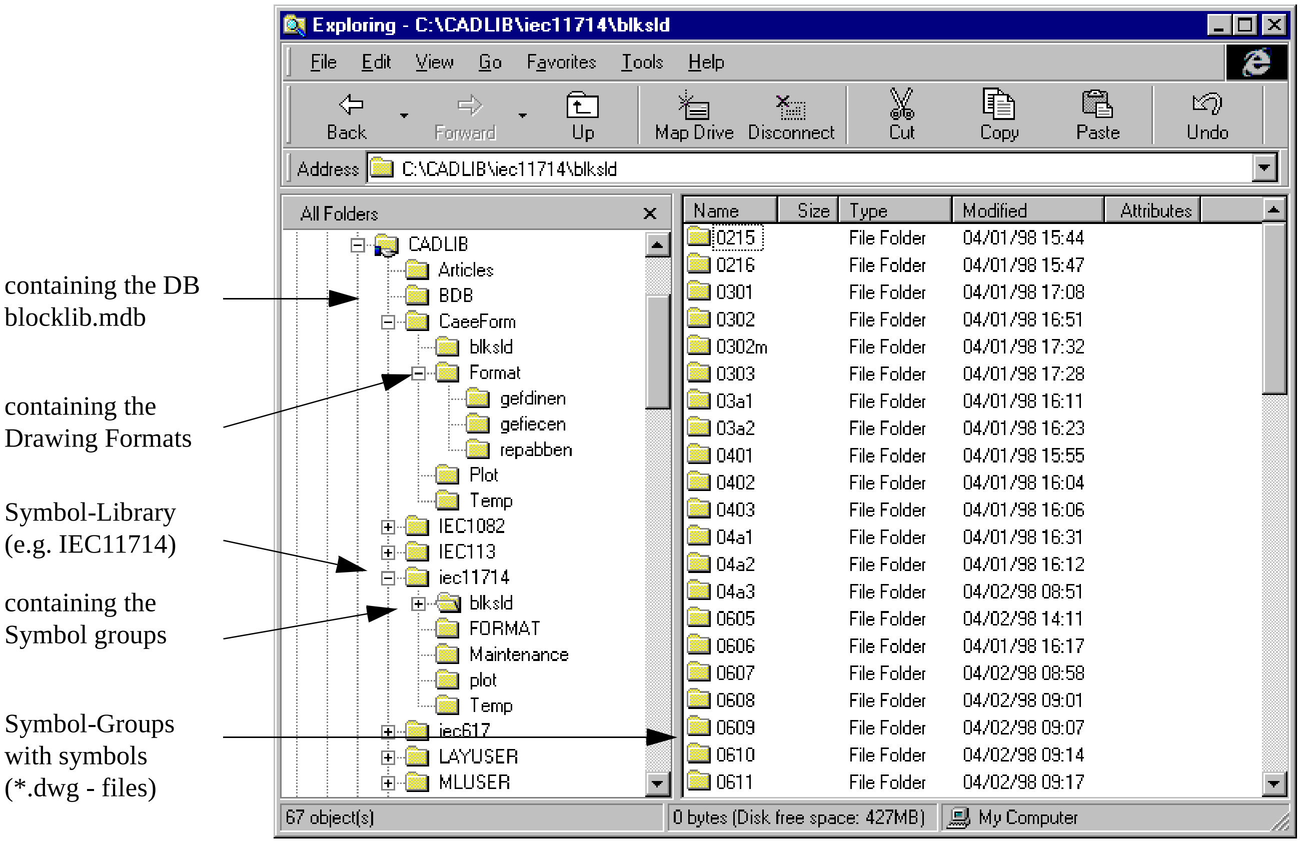
1.8.1 Electrical Diagram Builder

Refer to the corresponding section of the **Electrical Diagram Builder User's Guide**.

1.8.2 Library structures

1.8.2.1 Product Library Structure

The Product Library Structure **CADLIB**, located below the share **abtool1** in the installation directory **\caee\***ProductVersion*\ contains the Library Database BLOCKLIB.MDB and the Directory structure with subtrees for each individual library (e.g. IEC1082, IEC11714, ...). A Symbol library is further subdivided into Symbol groups and Symbol blocks (.dwg - files) or formats according to the elMaster design conventions.



Exploring - C:\CADLIB\iec11714\blksld

Address C:\CADLIB\iec11714\blksld

Name	Size	Type	Modified	Attributes
0215		File Folder	04/01/98 15:44	
0216		File Folder	04/01/98 15:47	
0301		File Folder	04/01/98 17:08	
0302		File Folder	04/01/98 16:51	
0302m		File Folder	04/01/98 17:32	
0303		File Folder	04/01/98 17:28	
03a1		File Folder	04/01/98 16:11	
03a2		File Folder	04/01/98 16:23	
0401		File Folder	04/01/98 15:55	
0402		File Folder	04/01/98 16:04	
0403		File Folder	04/01/98 16:06	
04a1		File Folder	04/01/98 16:31	
04a2		File Folder	04/01/98 16:12	
04a3		File Folder	04/02/98 08:51	
0605		File Folder	04/02/98 14:11	
0606		File Folder	04/01/98 16:17	
0607		File Folder	04/02/98 08:58	
0608		File Folder	04/02/98 09:01	
0609		File Folder	04/02/98 09:07	
0610		File Folder	04/02/98 09:14	
0611		File Folder	04/02/98 09:17	

67 object(s) | 0 bytes (Disk free space: 427MB) | My Computer

containing the DB blocklib.mdb

containing the Drawing Formats

Symbol-Library (e.g. IEC11714)

containing the Symbol groups

Symbol-Groups with symbols (*.dwg - files)

Figure 1-3. Product Library structure

Table 1-4. Product Library Directories

Directory / Subdirectory	Description
CADLIB	Product Library Structure
- Article	Databases Article_Catalog.mdb and Cable_Catalog.mdb
- BDB	Database Blocklib.mdb with descriptions (tables) for Symbols, Formats and Title Block Mapping.

Table 1-4. Product Library Directories

Directory / Subdirectory	Description
- CaeeForm	Format templates A0 - A4, Q4 portrait and landscape with title- and revision blocks
- iec1082 - iec113 - iec617 - iec11714	Symbol library trees
- - blksld	containing the subdirectories of symbol-groups
- - - 0215, ...	Symbol groups with Symbols (*.dwg-files)
- - maintenance	see Section 1.8.2.2, Maintenance Library Structure

1.8.2.2 Maintenance Library Structure

The **Maintenance Library Structure** contains the symbol exchange drawings, i.e. Symbol Report files in **Standard Report Format**. This drawings are reports created from the symbol groups and contain all required symbol information (including the database entries for the Blocklibrary) to exchange the library with other users between product installations. Refer to the *el*Master design User's Manual for a description how to create Standard Reports.

The directory structure of the Maintenance Library is free and can be modified and extended according to your needs.

1.8.2.3 Data Flow between Maintenance- and Product Library

With the elMaster design function **Blockbuild | Blocklib | Admin** you can read the **Standard Report Format** *<symbolgroup>. dwg* from the **Maintenance Library Structure** to import the symbol information into the database **BLOCKLIB** and to store the individual symbol blocks *<symbolname>.dwg* into the selected **Project Library** directories (see Figure 1-4).

The actual state of the symbols in the Symbol Library can be exported by reporting the symbols. This function creates a new Standard Report File *<symbolgroup>. dwg.*

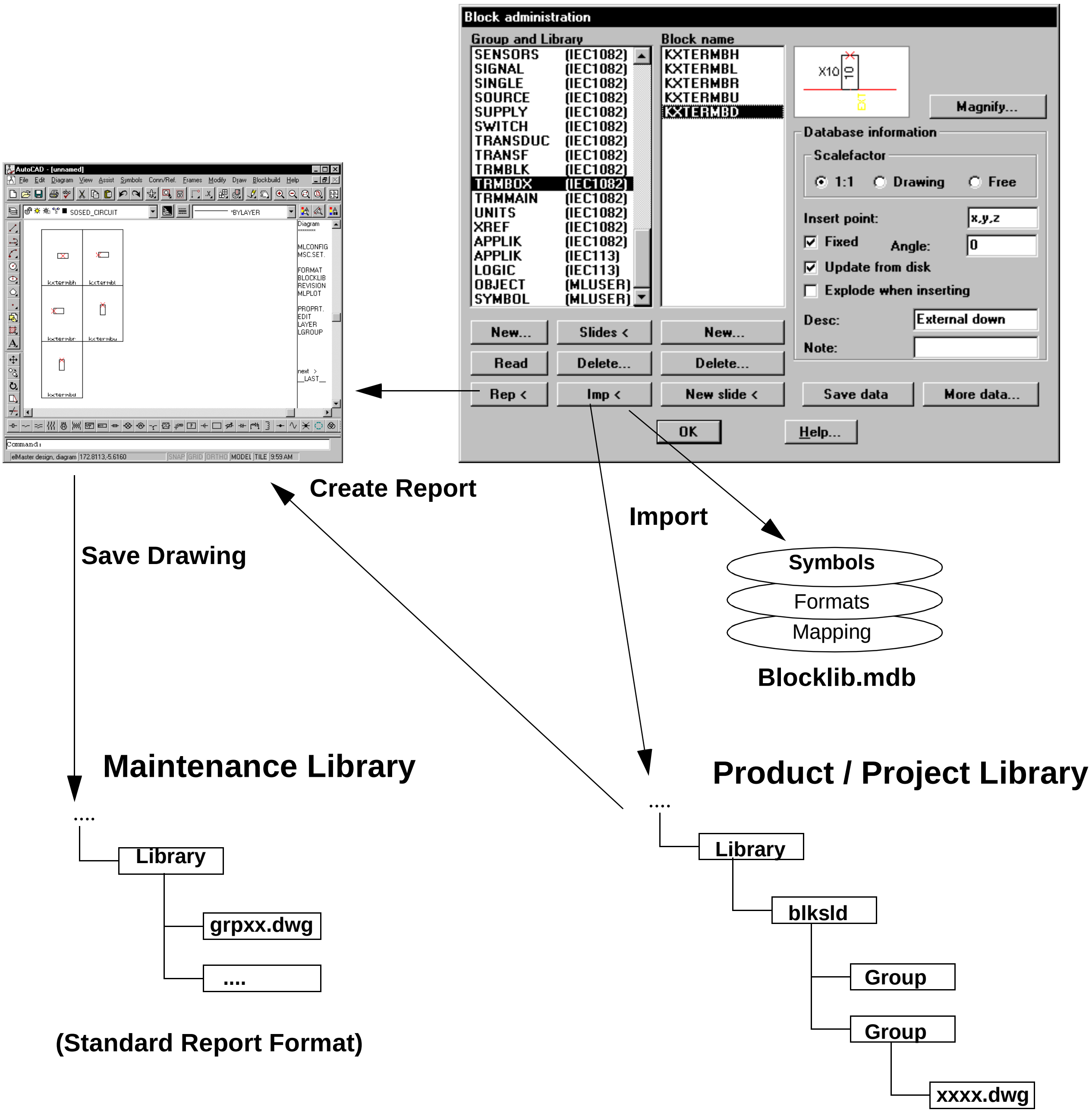


Figure 1-4. Data Flow between Maintenance and Product Library

1.9 User Interface

The functions of Electrical Diagram Builder are implemented by Windows programs with the typical graphic user interface and look-and-feel of Windows programs.

The dialogs that will appear on the screen, normally have Help buttons. Clicking this button will open the Electrical Diagram Builder’s on-line help, where you will get context-sensitively help to the actual topic.

The user interface to create drawings is based on the well-known functionality from AutoCAD extended by additional functions for electrical CAD-applications.

The user interface to the database is implemented with Microsoft Access. This allows all users to easily adapt reports and forms and to gain from the full set of functions provided by Microsoft Access.

Chapter 2 Installation

For the description how to install the Electrical Diagram Builder refer to the *Electrical Diagram Builder Release Notes*.

Chapter 3 Configuration/Application Building

For the description how to use the Electrical Diagram Builder refer to the *Electrical Diagram Builder User's Guide*.

Chapter 4 Runtime Operation

4.1 Operating Overview

Not applicable here.

4.2 Runtime Tutorial

Not applicable here.

4.3 Operating Instructions

Not applicable here.

4.4 Runtime Operation Menus

Not applicable here.

Chapter 5 Maintenance

5.1 Preventive Maintenance

Not applicable here.

5.2 Hardware Indicators

Not applicable here.

5.3 Error Messages

Not applicable here.

5.4 Fault Finding and User Repair

Not applicable here.

5.5 Backup/Restore Procedures

Not applicable here.

Appendix A Guideline for Building Formats

A.1 General rules

Paper sheet sizes
(see also Table 1 of ISO 5457/DIN 6771-6)

Table A-1. Relevant paper sheet sizes within Electrical Diagram Builder

Size	trimmed dimensions, mm
A0	841 x 1 189
A1	594 x 841
A2	420 x 594
A3	297 x 420
A4	210 x 297
US letter	215,9 x 279,4

General remark concerning lettering and lines:

The recommended measures depend on the selected module (M). According to IEC standards a minimum module M=2.5 mm is allowed. According to DIN a minimum module M=2.0 mm is possible. The numbers within the following tables are related to minimum module M=2.5mm.

Line thickness:
It is recommended that you use a minimum line thickness of 0.1xM=0,25 mm for A4, A3 and A2 size documents, 0,35 mm for A0 and A1 size documents.

Table A-2. Recommended line thickness within Diagram Builder

	A0	A1	A2	A3	A4
Thick lines	1.0	1.0	0.7	0.5/0,7(1)	0.5/0,7(1)
Medium lines	0.5	0.5	0.35	0.35	0.35
Thin lines	0.35	0.35	0.25	0.25	0.25

(1) 0.5 mm concerning Corporate Standard, 0.7 mm concerning DIN 6771-1

Minimum height of lettering related to sheet size:

Table A-3. Table 2 of ISO 5457

Lettering ISO 3098/10	**A0**	**A1**	**A2**	**A3**	**A4**
A(h = 14d)	5	5	3.5	3.5	3.5
B(h = 10d)	3.5	3.5	2.5	2.5	2.5

Table A-4. Recommended heights within Electrical Diagram Builder, lettertype B

	A0	**A1**	**A2**	**A3**	**A4**
Drawing titles	5	5	3.5	3.5	3.5
Draw/Document numbers	7	7	5	5	5
Other attributes	3.5	3.5	2.5 (=M)	2.5(=M)	2.5(=M)
Label texts	2.5	2.5	1.8	1.8	1.8

Layers and Styles for frames, title blocks and revision blocks

- All lines, texts and attributes should be placed on **layer 0**. 1)
- As linetype must be set "**by layer**"
- Medium/thick lines must be made by **polylines**
- Recommended style for attributes within title/revision block is "**Standard**"
- Recommended style for fix label text within title/revision block is "**Label**".

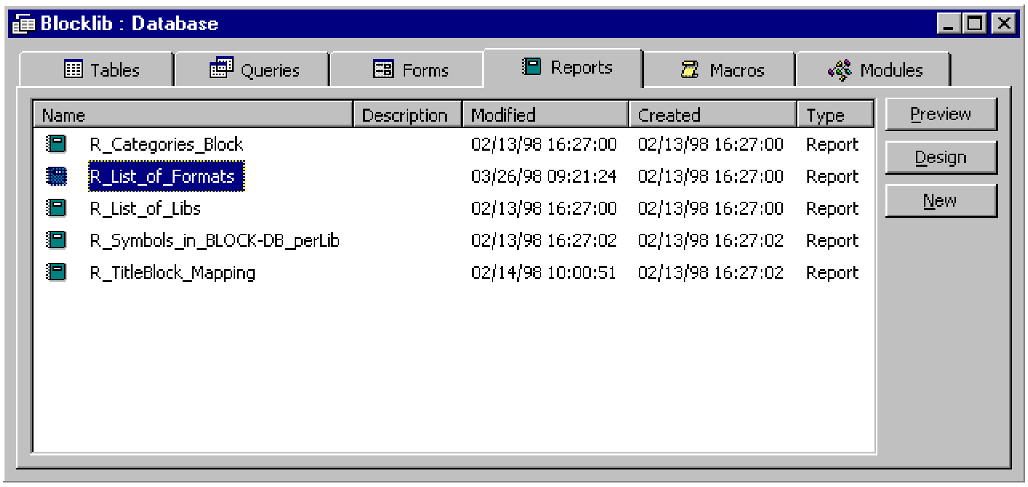
---

1. In this case during insert of the format, lines, texts and attributes are mapped to the actual layer.

A.2 Formats

A.2.1 List of Formats report

The actual list of available formats can be documented by an ACCESS-report included in the BLOCKLIB-Database **...\cadlib\bdb\blocklib.mdb**

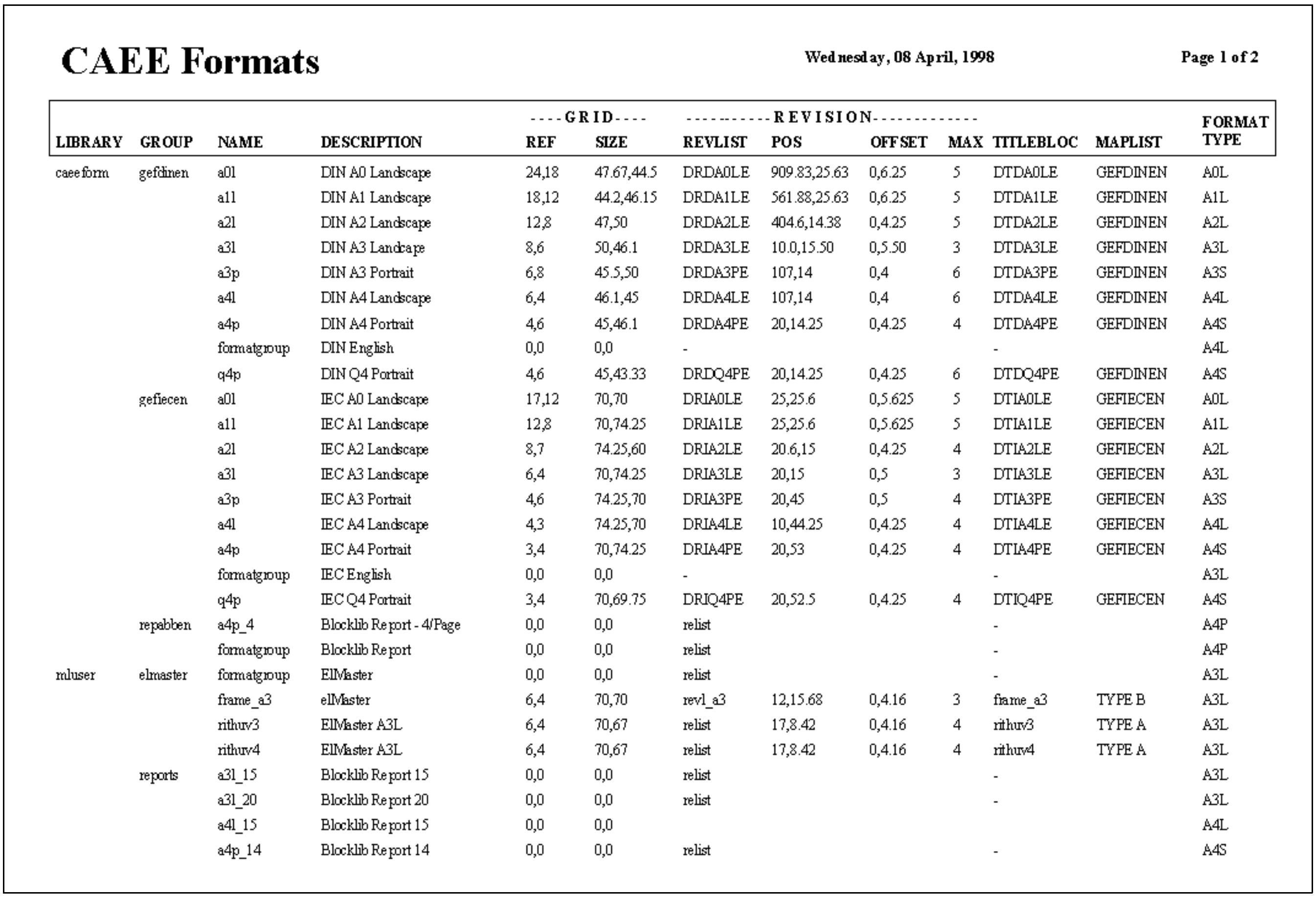


Name	Description	Modified	Created	Type
R_Categories_Block		02/13/98 16:27:00	02/13/98 16:27:00	Report
R_List_of_Formats		03/26/98 09:21:24	02/13/98 16:27:00	Report
R_List_of_Libs		02/13/98 16:27:00	02/13/98 16:27:00	Report
R_Symbols_in_BLOCK-DB_perLib		02/13/98 16:27:02	02/13/98 16:27:02	Report
R_TitleBlock_Mapping		02/14/98 10:00:51	02/13/98 16:27:02	Report

Figure A-1. Activate the Report List_of_Formats

Activate the report **R_List_of_Formats:**

The report is shown on the next page, Figure A-2, Result of Report List_of_Formats



CAEE Formats

Wednesday, 08 April, 1998

Page 1 of 2

				----GRID----		-----------REVISION-------------						
LIBRARY	**GROUP**	**NAME**	**DESCRIPTION**	**REF**	**SIZE**	**REVLIST**	**POS**	**OFFSET**	**MAX**	**TITLEBLOC**	**MAPLIST**	**FORMAT TYPE**
caeeform	gefdinen	a0l	DIN A0 Landscape	24,18	47.67,44.5	DRDA0LE	909.83,25.63	0,6.25	5	DTDA0LE	GEFDINEN	A0L
		a1l	DIN A1 Landscape	18,12	44.2,46.15	DRDA1LE	561.88,25.63	0,6.25	5	DTDA1LE	GEFDINEN	A1L
		a2l	DIN A2 Landscape	12,8	47,50	DRDA2LE	404.6,14.38	0,4.25	5	DTDA2LE	GEFDINEN	A2L
		a3l	DIN A3 Landcape	8,6	50,46.1	DRDA3LE	10.0,15.50	0,5.50	3	DTDA3LE	GEFDINEN	A3L
		a3p	DIN A3 Portrait	6,8	45.5,50	DRDA3PE	107,14	0,4	6	DTDA3PE	GEFDINEN	A3S
		a4l	DIN A4 Landscape	6,4	46.1,45	DRDA4LE	107,14	0,4	6	DTDA4LE	GEFDINEN	A4L
		a4p	DIN A4 Portrait	4,6	45,46.1	DRDA4PE	20,14.25	0,4.25	4	DTDA4PE	GEFDINEN	A4S
		formatgroup	DIN English	0,0	0,0	-				-		A4L
		q4p	DIN Q4 Portrait	4,6	45,43.33	DRDQ4PE	20,14.25	0,4.25	6	DTDQ4PE	GEFDINEN	A4S
	gefiecen	a0l	IEC A0 Landscape	17,12	70,70	DRIA0LE	25,25.6	0,5.625	5	DTIA0LE	GEFIECEN	A0L
		a1l	IEC A1 Landscape	12,8	70,74.25	DRIA1LE	25,25.6	0,5.625	5	DTIA1LE	GEFIECEN	A1L
		a2l	IEC A2 Landscape	8,7	74.25,60	DRIA2LE	20.6,15	0,4.25	4	DTIA2LE	GEFIECEN	A2L
		a3l	IEC A3 Landscape	6,4	70,74.25	DRIA3LE	20,15	0,5	3	DTIA3LE	GEFIECEN	A3L
		a3p	IEC A3 Portrait	4,6	74.25,70	DRIA3PE	20,45	0,5	4	DTIA3PE	GEFIECEN	A3S
		a4l	IEC A4 Landscape	4,3	74.25,70	DRIA4LE	10,44.25	0,4.25	4	DTIA4LE	GEFIECEN	A4L
		a4p	IEC A4 Portrait	3,4	70,74.25	DRIA4PE	20,53	0,4.25	4	DTIA4PE	GEFIECEN	A4S
		formatgroup	IEC English	0,0	0,0	-				-		A3L
		q4p	IEC Q4 Portrait	3,4	70,69.75	DRIQ4PE	20,52.5	0,4.25	4	DTIQ4PE	GEFIECEN	A4S
	repabben	a4p_4	Blocklib Report - 4/Page	0,0	0,0	relist				-		A4P
		formatgroup	Blocklib Report	0,0	0,0	relist				-		A4P
mluser	elmaster	formatgroup	ElMaster	0,0	0,0	relist				-		A3L
		frame_a3	elMaster	6,4	70,70	revl_a3	12,15.68	0,4.16	3	frame_a3	TYPE B	A3L
		rithuv3	ElMaster A3L	6,4	70,67	relist	17,8.42	0,4.16	4	rithuv3	TYPE A	A3L
		rithuv4	ElMaster A3L	6,4	70,67	relist	17,8.42	0,4.16	4	rithuv4	TYPE A	A3L
	reports	a3l_15	Blocklib Report 15	0,0	0,0	relist				-		A3L
		a3l_20	Blocklib Report 20	0,0	0,0	relist				-		A3L
		a4l_15	Blocklib Report 15	0,0	0,0							A4L
		a4p_14	Blocklib Report 14	0,0	0,0	relist				-		A4S

Figure A-2. Result of Report List_of_Formats

A.3 Title Block Attribute Mapping

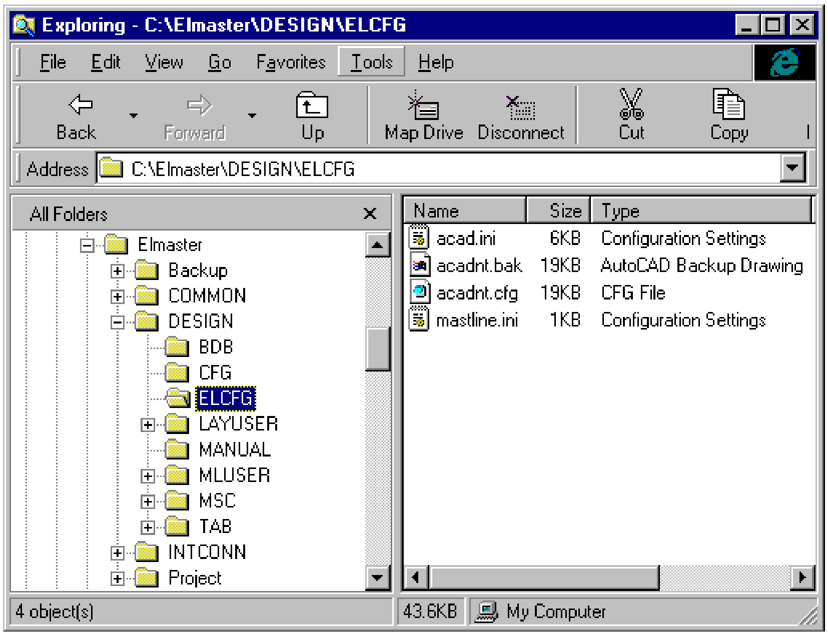
A.3.1 Related Tables and Files

A.3.1.1 Tables

Table A-5. Related Tables

ODBC Data Source	Database	Table	Description
SOS_BLOCKLIB	BLOCKLIB.MDB	FORMATS	List of all defined Format-Templates
		MAPPING	Mapping of Title Block Attributes
ECAE	EDIB Database	COTPROJS	Project Data
		DOTDOCS	Document Data
		DOTFORMS	Document File Data
		DOTREVS	Document Revision Data

A.3.1.2 Files



Exploring - C:\Elmaster\DESIGN\ELCFG

Address C:\Elmaster\DESIGN\ELCFG

Name	Size	Type
acad.ini	6KB	Configuration Settings
acadnt.bak	19KB	AutoCAD Backup Drawing
acadnt.cfg	19KB	CFG File
mastline.ini	1KB	Configuration Settings

Figure A-3. Directory of Configuration Files

A.3.2 Attribute Mapping

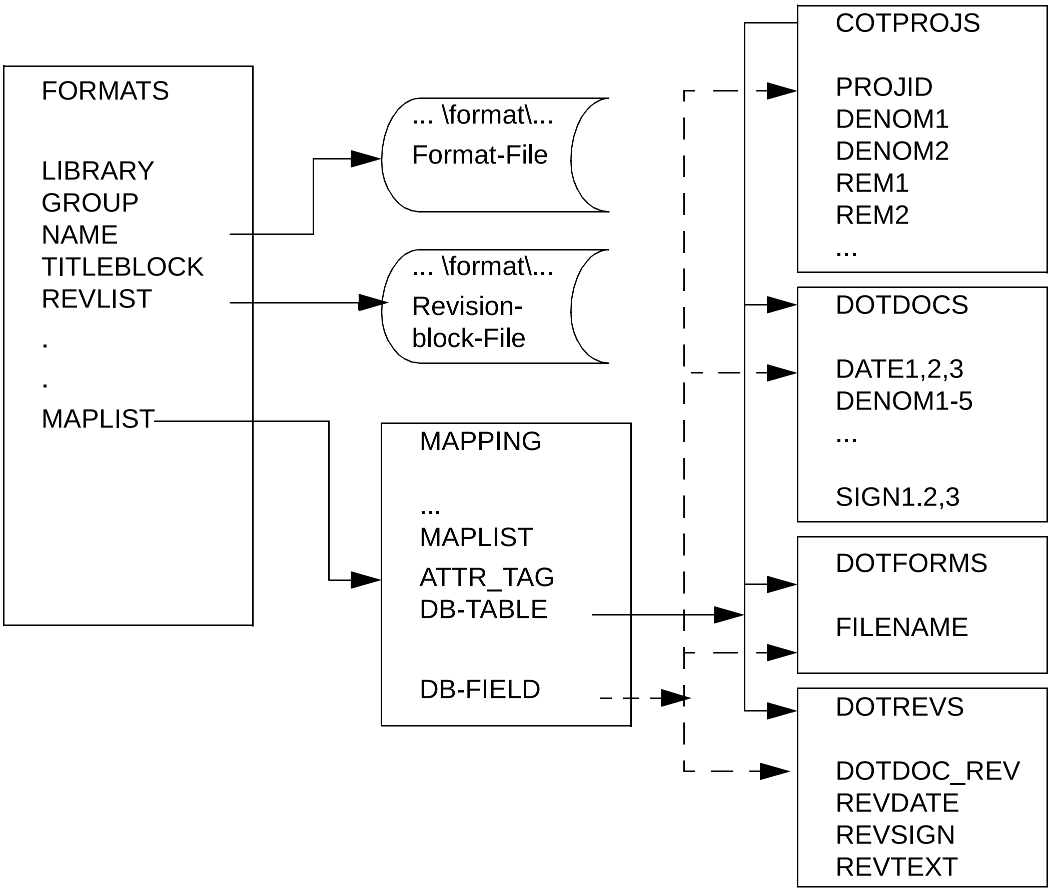


Figure A-4. Overview Attribute mapping

A.3.3 Standard Title Block Attributes

The insertion point of the title block is the bottom right hand corner.

Defaults for attributes: Style: Standard, Layer: 0, Height: see tab.

Table A-6. Definitions for title block attributes

TAG	Prompt Text	Exceptions
REV_IDX	Revision Index	
DOC_NUMBER	Document number	
DOC_PAGE	Sheet number	

Table A-6. Definitions for title block attributes

TAG	Prompt Text	Exceptions
NEXTSHEET	Continuation sheet	only relevant for IEC
NO_OF_SH	Number of sheets	only relevant for DIN
DOC_DESC1,2,3,4	Title 1,2,3,4	
DOC_NAME1	Document type	
DOC_NAME2	Document designation	
DOC_KIND	Document kind code	
LANGUAGE	Language	
DOC_CREATED_WEE	Prepared (date)	
DOC_DESIGNER	Prepared (name)	
PRO_NAME	Project name	
CHK_DATE	Checked (date)	if possible in title block
DRAWINGCHECK	Checked (name)	
APPR_DATE	Approved (date)	if possible in title block
DESIGNCHECK	Approved (name)	
BASED_ON	Based on	
REPLACES	Replaces	
REPL_BY	Replaced by	
PRO_NAME	Project name (1)	
LG_DESC_1	Project name (2)	
LG_NAME	Project name (3)	
OWNER	Legal owner	
DOC_DESC5	Resp.Department	
CUST_DIS	For customer	

NOTE

The sequence of attributes within the table corresponds to the sequence within the title block symbol.

A.3.4 Optional Title Block Attributes

The following additional title block attributes can be used not included in IEC / DIN title blocks corresponding to corporate standard:

Table A-7. Optional title block attributes available in Electrical Diagram Builder

TAG	Prompt Text	Exeptions
STANDARD	Standard	
FACTORY	Factory	
PRO_NO	Project number	
DOC_FULL_FILENAME	File name	diagram: FILE_NAME
(FORMAT	Layout format	within drawing)
(SCALE	Scale factor	within drawing)
LM_DATE	Last modified date	not yet used
PR_DATE	Print date	not yet used

A.3.5 Revision Blocks

Revision blocks can be duplicated manually to handle several revisions within a diagram.
A consecutive numbering can be done by attribute REV_NO.

Defaults for attributes: Style: Standard, Layer: 0, Height: see tab.

Table A-8. Definition of revision block attributes in Electrical Diagram Builder

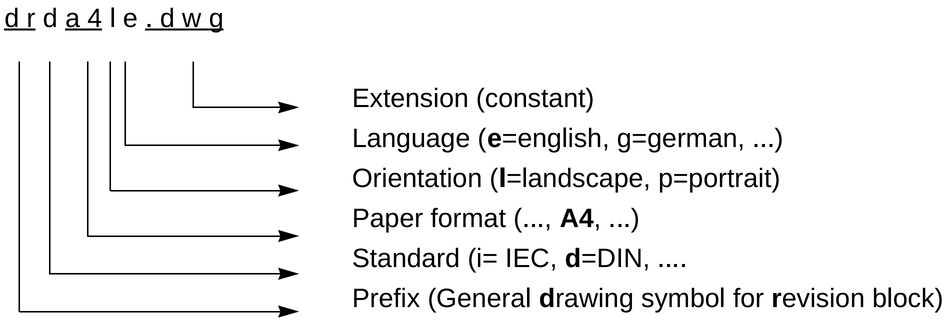
TAG	Prompt Text	Exceptions
REV_NO	Rev.Number	set invisible (for future internal use)
REV_IDX	Rev.Index	
REV_DATE	Rev.Date	
REV_NAME	Rev.Name	
REV_NOTE	Rev.Note	

NOTE

The sequence of attributes within the table corresponds to the sequence within the revision block symbol.

A.3.5.1 Naming conventions for revision blocks

The predefined Revision Block formats are stored in the client directory...\Elmaster\MSC according the following naming conventions:



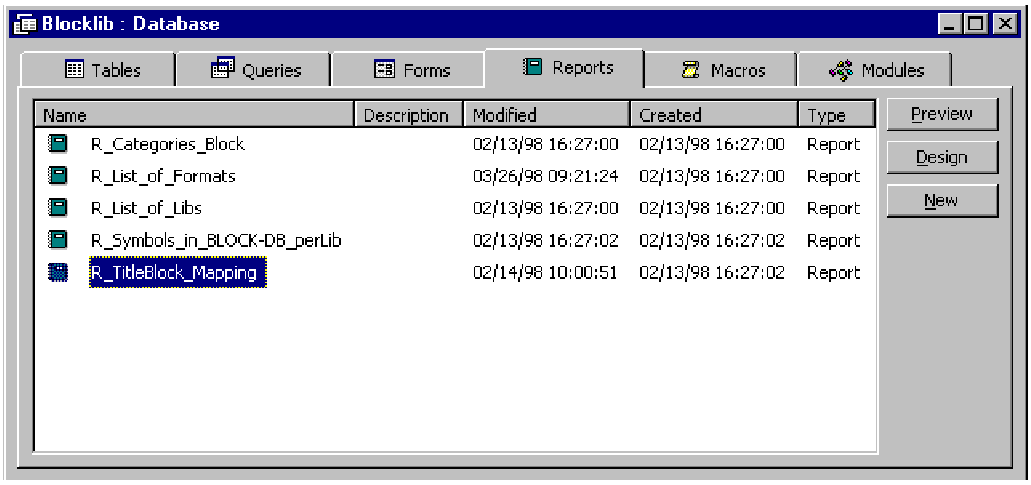
drda4le.dwg

Extension (constant)
Language (**e**=english, g=german, ...)
Orientation (**l**=landscape, p=portrait)
Paper format (..., **A4**, ...)
Standard (i= IEC, **d**=DIN, ...
Prefix (General **d**rawing symbol for **r**evision block)

See also Section A.9, Naming Conventions.

A.3.6 Title Block Attribute Mapping Report

The actual state of attribute mapping can be documented by an ACCESS-report included in the BLOCKLIB-Database **...\cadlib\bdb\blocklib.mdb**

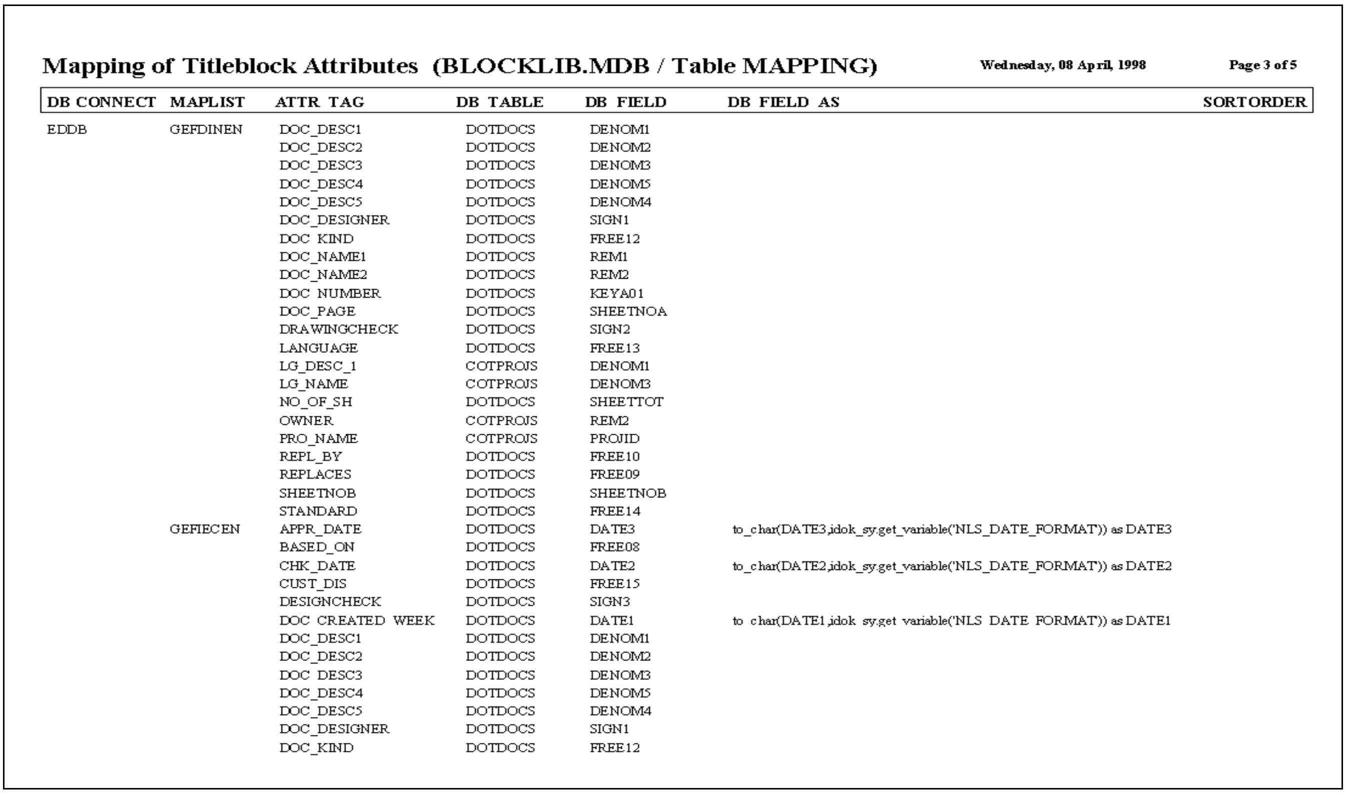


Name	Description	Modified	Created	Type
R_Categories_Block		02/13/98 16:27:00	02/13/98 16:27:00	Report
R_List_of_Formats		03/26/98 09:21:24	02/13/98 16:27:00	Report
R_List_of_Libs		02/13/98 16:27:00	02/13/98 16:27:00	Report
R_Symbols_in_BLOCK-DB_perLib		02/13/98 16:27:02	02/13/98 16:27:02	Report
R_TitleBlock_Mapping		02/14/98 10:00:51	02/13/98 16:27:02	Report

Figure A-5. Activate the Attribute-Mapping-Report

Activate the report **R_Titleblock_Mapping**

The report is shown on the next page, Figure A-6, Result of Attribute-Mapping-Report



Mapping of Titleblock Attributes (BLOCKLIB.MDB / Table MAPPING) **Wednesday, 08 April, 1998** **Page 3 of 5**

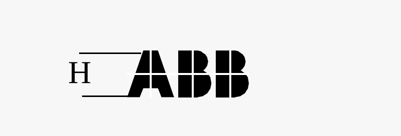
DB CONNECT	MAPLIST	ATTR TAG	DB TABLE	DB FIELD	DB FIELD AS	SORTORDER
EDDB	GEFDINEN	DOC_DESC1	DOTDOCS	DENOM1		
		DOC_DESC2	DOTDOCS	DENOM2		
		DOC_DESC3	DOTDOCS	DENOM3		
		DOC_DESC4	DOTDOCS	DENOM5		
		DOC_DESC5	DOTDOCS	DENOM4		
		DOC_DESIGNER	DOTDOCS	SIGN1		
		DOC KIND	DOTDOCS	FREE12		
		DOC_NAME1	DOTDOCS	REM1		
		DOC_NAME2	DOTDOCS	REM2		
		DOC NUMBER	DOTDOCS	KEYA01		
		DOC_PAGE	DOTDOCS	SHEETNOA		
		DRAWINGCHECK	DOTDOCS	SIGN2		
		LANGUAGE	DOTDOCS	FREE13		
		LG_DESC_1	COTPROJS	DENOM1		
		LG_NAME	COTPROJS	DENOM3		
		NO_OF_SH	DOTDOCS	SHEETTOT		
		OWNER	COTPROJS	REM2		
		PRO_NAME	COTPROJS	PROJID		
		REPL_BY	DOTDOCS	FREE10		
		REPLACES	DOTDOCS	FREE09		
		SHEETNOB	DOTDOCS	SHEETNOB		
		STANDARD	DOTDOCS	FREE14		
	GEFIECEN	APPR_DATE	DOTDOCS	DATE3	to_char(DATE3,idok_sy.get_variable('NLS_DATE_FORMAT')) as DATE3	
		BASED_ON	DOTDOCS	FREE08		
		CHK_DATE	DOTDOCS	DATE2	to_char(DATE2,idok_sy.get_variable('NLS_DATE_FORMAT')) as DATE2	
		CUST_DIS	DOTDOCS	FREE15		
		DESIGNCHECK	DOTDOCS	SIGN3		
		DOC CREATED WEEK	DOTDOCS	DATE1	to char(DATE1,idok sy.get variable('NLS DATE FORMAT')) as DATE1	
		DOC_DESC1	DOTDOCS	DENOM1		
		DOC_DESC2	DOTDOCS	DENOM2		
		DOC DESC3	DOTDOCS	DENOM3		
		DOC_DESC4	DOTDOCS	DENOM5		
		DOC_DESC5	DOTDOCS	DENOM4		
		DOC_DESIGNER	DOTDOCS	SIGN1		
		DOC_KIND	DOTDOCS	FREE12		

Figure A-6. Result of Attribute-Mapping-Report

A.4 Logo

Rules for ABB Logo

- H = 6 mm ”extra bold” for A4, A3 and A2
  H = 8 mm ”extra bold” for A1, A0
  Design according to Corporate Standard 9ADA 127(B8).



A.5 Grid reference system

- The frame symbol must have folder marks.
- The areas within sheet are identified by a grid reference system.
- The grid shall not be less than 25 mm and not more than 75 mm (IEC 1082-1).

NOTE

Corporate Standard recommends 60-75 mm.

- In X-direction numerical values (1,2,.....) are used for the grid reference system.
- In Y-direction alphabetical values (A,B,....) are used.

Table A-9. Recommended values for grid reference system within the Electrical Diagram Builder

sheet size	A0L	A1L	A2L	A3L	A4L	A4P
X-direction (1,2..)	1 - 24	1 - 18	1 - 12	1 - 8	1 - 6	1 - 4
Y-direction (A,B,..)	A - R	A - L	A - H	A - F	A - D	A - F

A.6 Sheet layout

General rules/restrictions for diagram/drawing formats

- Related to restrictions of printers, the minimum not printable border area is 5 mm.
- To get an original drawing, a layout format must be printable on the corresponding paper size without any scaling.
- The borders have a minimum width of 10 mm for all sizes.

NOTE

For the grid reference system remain therefore 5 mm.

- A filing margin for taking perforation is provided.
  This margin has a minimum width of 17 mm corresponding to IEC.
  This margin has a minimum width of 18 mm corresponding to DIN.
  Within Diagram Builder 20 mm is recommended.

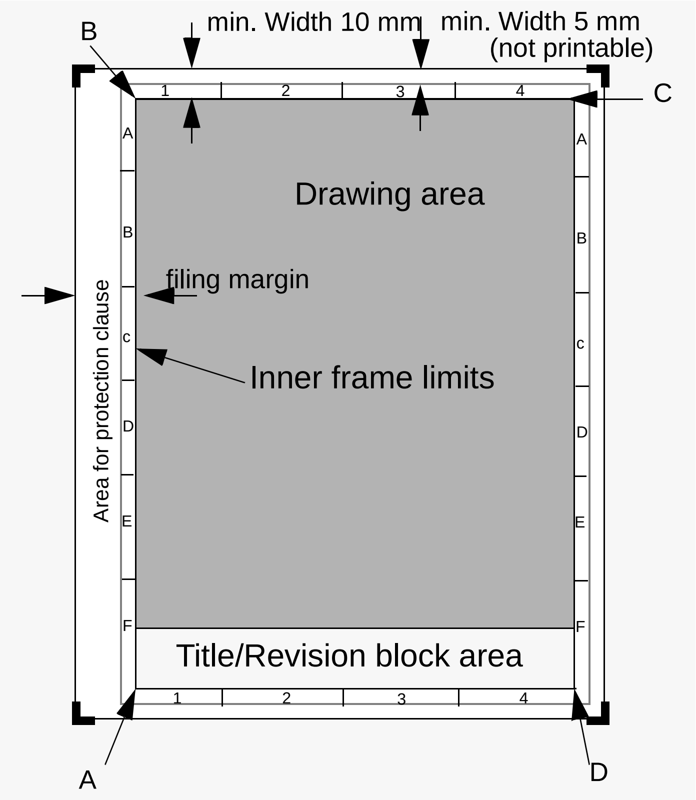


Figure A-7. Sheet layout A4P,Q4P,A3P corresponding DIN/IEC

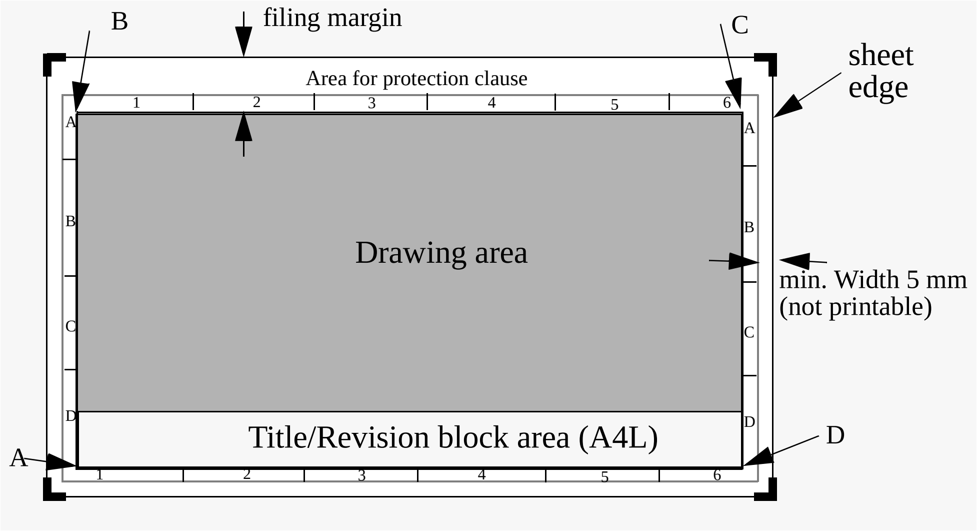

B
filing margin
C
sheet edge
Area for protection clause
1
2
3
4
5
6
A
B
C
D
Drawing area
min. Width 5 mm (not printable)
Title/Revision block area (A4L)
D
A

Figure A-8. Sheet layout A4L corresponding to DIN/IEC

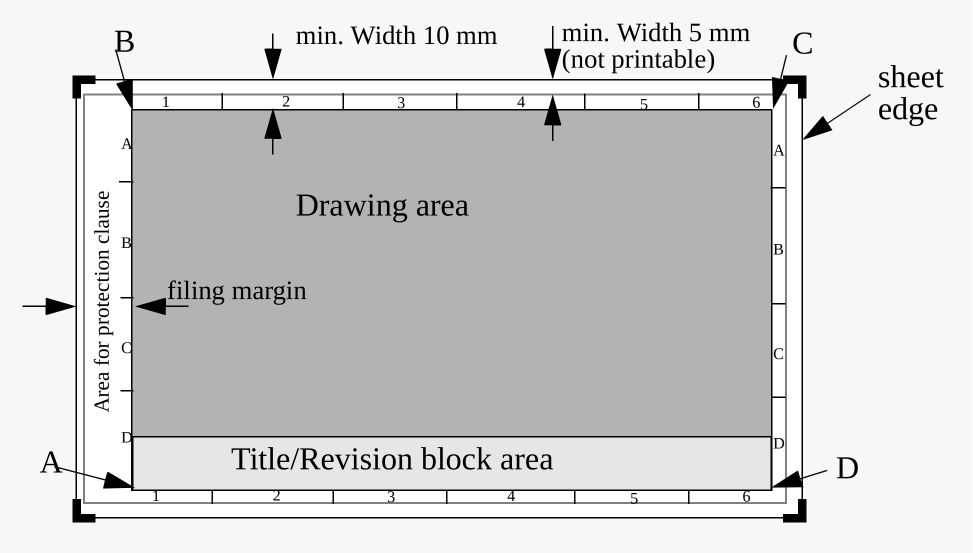

B
min. Width 10 mm
min. Width 5 mm (not printable)
C
sheet edge
1
2
3
4
5
6
A
B
C
D
Drawing area
Area for protection clause
filing margin
Title/Revision block area
A
D

Figure A-9. Sheet layout A3L corresponding to IEC

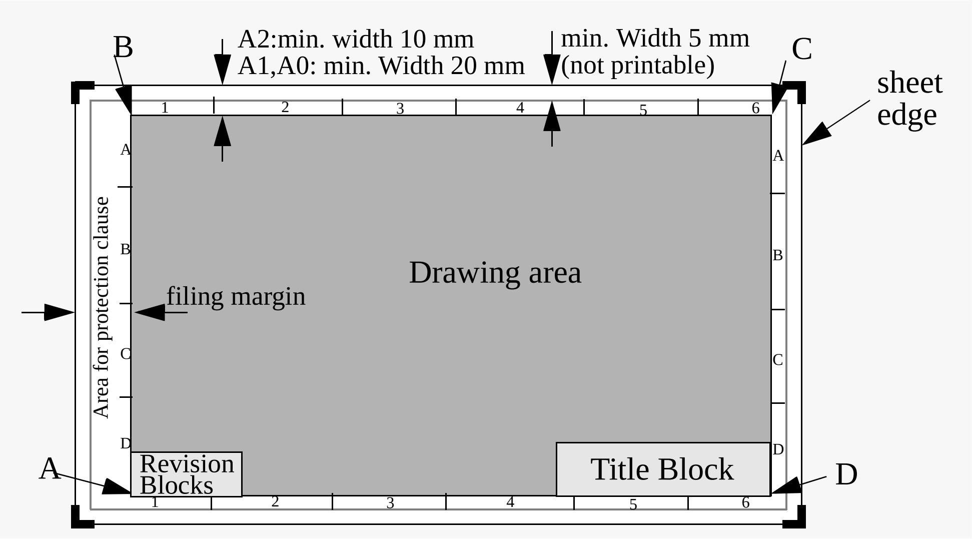


Figure A-10. Sheet layout A2,A1,A0 corresponding to DIN/IEC

Sheet layout A3L corresponding to DIN

For A3L diagrams within DIN 67710-5 an exception is specified related to the other parts of DIN 67710.

The title block width is defined in DIN 67710-5 as 410 mm. But to consider the 5 mm not printable area on each side, it’s reduced in Electrical Diagram Builder to 400 mm.

NOTE

DIN 67710 is not consistent in itself. DIN 67710-6 requires a free space of 5mm between sheet edge and grid reference system. In DIN 67710-5 this is not considered. But for practical reasons the free space of 5 mm is needed. The pre-standard DIN V 40 719 T 1000 shows the correct relations (margin 10 mm), but says nothing about the difference to DIN 67710-5 it is based on.

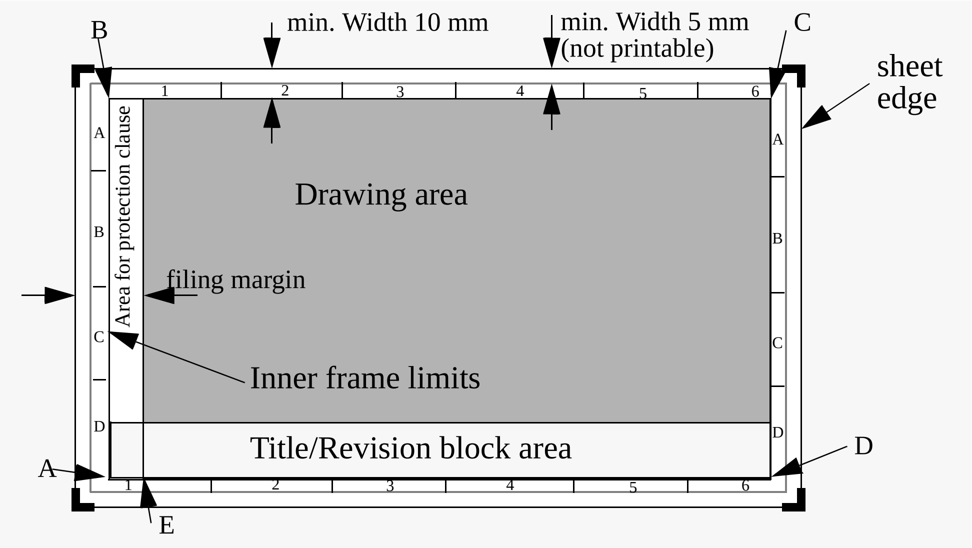


Figure A-11. Sheet layout A3L corresponding to DIN

Table A-10. Recommended coordinates for sheet layout in Electrical Diagram Builder

	A (x,y)	C(x,y)
A0L	25,20	1169,821
A1L	25,20	821,574
A2L	20,10	584,410
A3L IEC	20,10	410,287
A3L DIN	10,10	410,287
A3P	20,10	287,410
A4L	10,10	287,190
A4P	20,10	200,287
Q4P	20,10	200,269

NOTE

The common area of US-letter size and A4 size is 210 x 279,4 mm and is called Q4.

See also Figure A-14, Mapping Q4 layout format to A4/US Letter paper format

A.7 Title/Revision Block Layout

The base point of the title block is bottom right. The insertion point of the title block corresponds to the bottom right point of the drawing area (point D).

If the revision block is handled separately from the title block, the base point of the revision block is bottom left. The insertion point of the revision block depends on layout format and revision block number.

DIN 6771-T1,T5
The distance between lines within title/revision blocks is fixed at 4.23 mm (= 1/6 inch) for A2, A3 and A4. For A0 and A1, 5.6 mm is recommended.

NOTE

The numbers are based on line distances for line printers. This may not be relevant for modern graphic printers.

ISO WD 7200:1993 (draft)
The distance between lines within title/revision blocks is fixed at 4.5 mm for A2, A3 and A4.

The layout for title/revision blocks for

- A3L corresponding to DIN
- A4L, A4P, A3L, A2L, A1L, A0L corresponding to IEC.

is described in Corporate Standard 9ADA 354.

For A3P corresponding to IEC it is recommended that you use the A4L title block from Corporate Standard 9ADA 354 but reduced to 267 mm.

Alternatively for A2L, A1L and A0L corresponding to IEC the A4P title block can also be used (with adaptations of line distance and letter height).

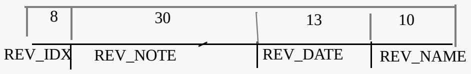
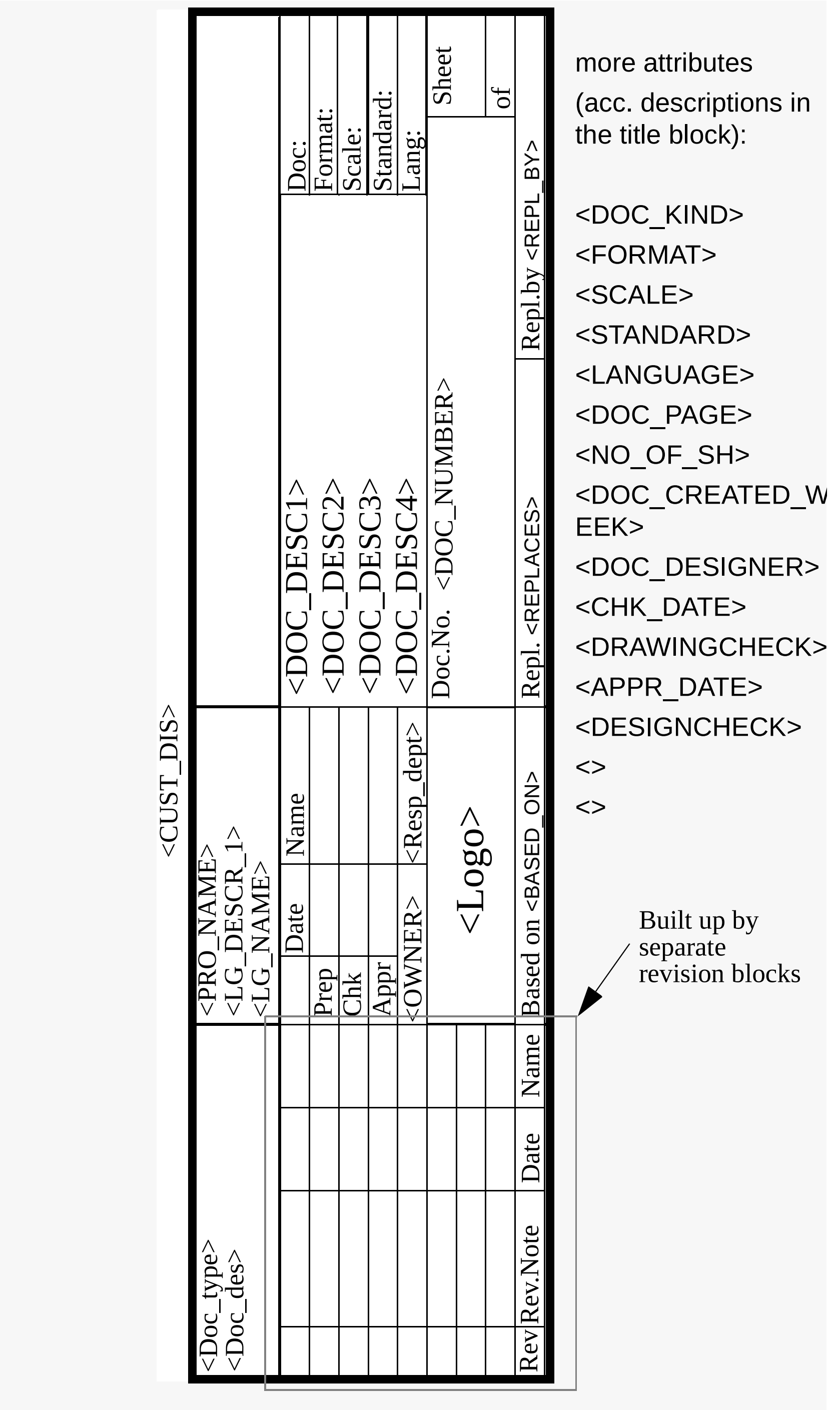


Figure A-12. Example for the layout of a revision block for DIN A3

One or several revision blocks should be inserted already in the completed frame/form.

For A4L/P, A3P, A2L, A1L and A0L corresponding to DIN, see Figure A-13, Title block designed corresponding to DIN for A4, A3P, A2, A1, A0.



more attributes

(acc. descriptions in the title block):

<DOC_KIND>
<FORMAT>
<SCALE>
<STANDARD>
<LANGUAGE>
<DOC_PAGE>
<NO_OF_SH>
<DOC_CREATED_WEEK>
<DOC_DESIGNER>
<CHK_DATE>
<DRAWINGCHECK>
<APPR_DATE>
<DESIGNCHECK>
<>
<>

Figure A-13. Title block designed corresponding to DIN for A4, A3P, A2, A1, A0

A.8 Scaling, rotation and offset for printout

Original drawings with a certain layout format must be printed/plotted on the corresponding paper size without any scaling (A4P/L -> A4, A3L/P -> A3,....).

For landscape a rotation of 270 degrees clockwise is assumed.

For printing big layout formats on smaller paper formats within the A-series a downscaling must be done. The not printable border of at least 5 mm should be considered.

The mapping for Q4 to A4 respectively US letter paper size is shown in Figure A-14, Mapping Q4 layout format to A4/US Letter paper format.

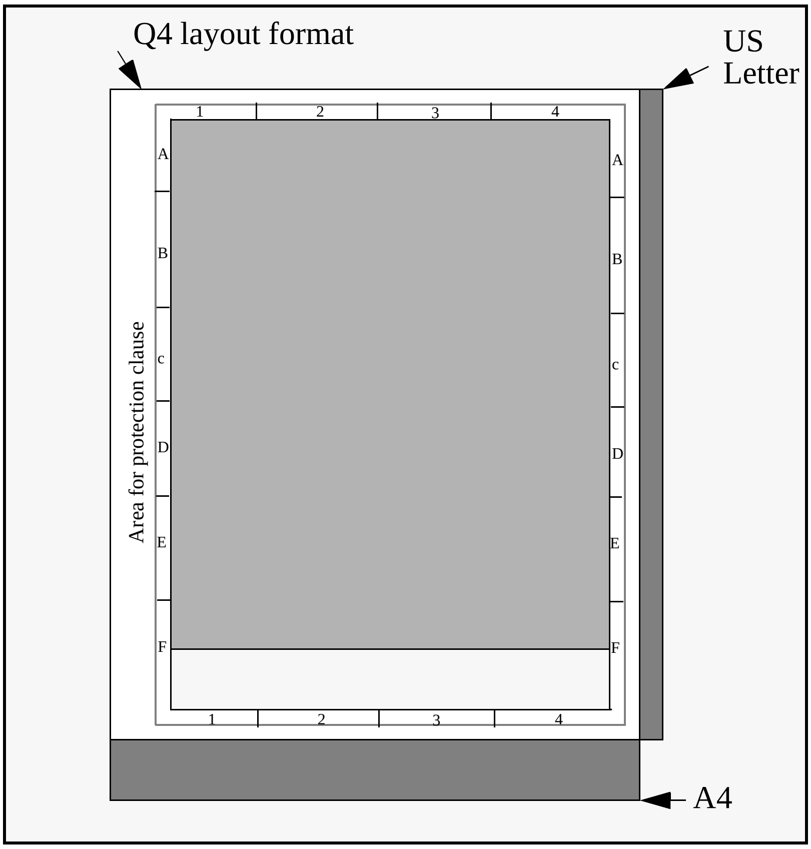


Figure A-14. Mapping Q4 layout format to A4/US Letter paper format

For printing A-layout formats on US letter paper an additional downscaling by factor 0.941 is done.

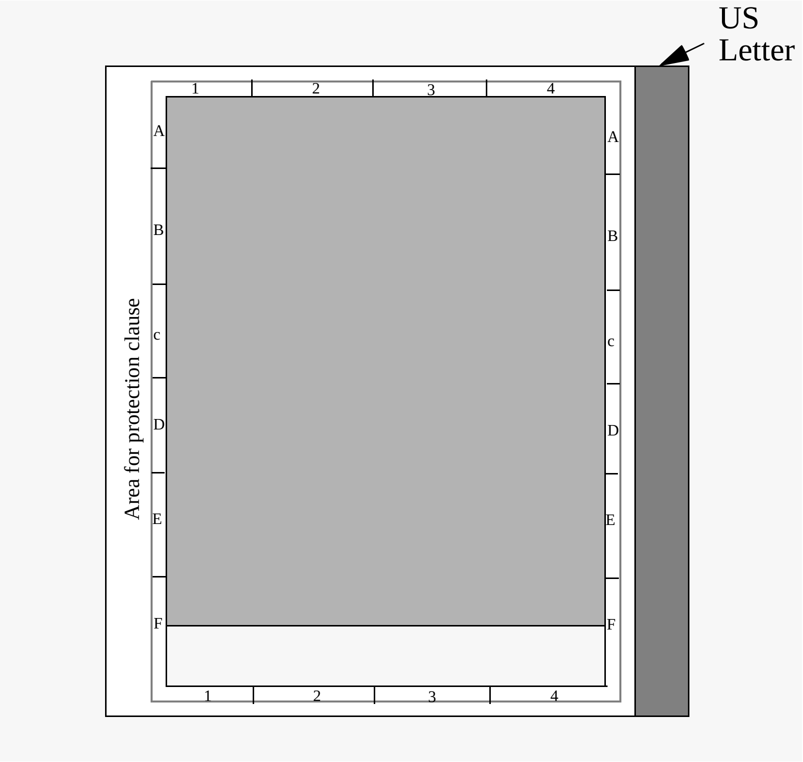


Figure A-15. Printing A-layout formats on US letter paper

A.9 Naming Conventions

The single symbols related to frames/formats should follow these naming conventions:

- 1. Letter: "d" for general drawing symbols
- 2. Letter: "f" for frame symbols
  "t" for title block symbols
  "r" for revision block symbols
  "l" for logos
- 3.Letter: "i" for iec standard
  "d" for din standard
  "c" for customer standard
  or own defined customer code
- 4-6 letter: layout format, for example, a3l, a4p,...
- 7,8 letter: for free use, may be used for language code, application code or numbering

Example:

"dtia3le-.dwg" means titleblock corresponding to IEC for A3L format, language English.

A.10 Workflow - Modification of Frames/Formats

A.10.1 General recommendations:

- Configuration points.
- The formats must not have there own configuration point, because the format block will be included in a drawing or a drawing template (configuration point already exist) - A second configuration point would be inserted.
  Result:
  A drawing with more than one configuration point could not be administrated and computed.
  by elMaster and the Electrical Diagram Builder.

  For this reason **don't use the function block | all** and
  don't save the format as a drawing !
- Use ElMaster functions (Toolbar "Modify") and not AutoCAD functions
- Use the ElMaster function "Attribute position" to rearrange the position of attributes.

A.10.2 Workflow

The modification of the Titleblock within a format describes the Workflow to modify the format templates:

1. **Open the Format.dwg** file including the format definition by using elMaster Design.
2. **Check and note the name and the insertion basepoint** of the Titleblock symbol (the right-lower corner) by using the command **DDMODIFY**

   e.g. (*DTIA3LE* 410.00 , 10.00
3. **Fill in the Common Item Designation block** with example values .
   (Menu item "Frame" - "Common Item Des.") - Check the position of the attributes.
   For further workflow steps, only a filled in Common Item Designation block can be selected and used.
4. Explode the required Block
5. **Modify the Block**
6. **Write back the block** *DTIA3LE*
   command "**wblock**" with the insertion basepoint (remembered in step 2.)

   If a defined range of attributes (used in the input mask of insert function) is desired, create the block according the following steps:

   a. insertion basepoint see above
   b. select all drawing elements which shall be incuded in the Titleblock symbol by mouseclick one by one.

   c. select all attribute elements of the Titleblock in opposite range of desired menu-presentation range
   (last selected attribute element will be the first attribute in the insert menu).

7. **Purge the block** *DTIA3LE* in the drawing (command **PURGE b**)
   The block definition in the header of drawing will be deleted.

8. **Insert the created block** in the template drawing with the remembered insertion basepoint.

9. **Clear** the example values of **Common Item Designation block**

10. Write back the drawing-Format (Use the command **wblock** - not **save** or **save as)**

    – Remember the configuration point problem!

Appendix B Structuring and Naming Conventions for Symbol Libraries

B.1 Introduction

B.1.1 Summary

This appendix describes:

- Categories into which symbol libraries must be separated
- Which naming conventions must be followed for defining symbols
- How to organize the symbol libraries on file systems given different Diagram Builder applications.

B.1.2 Background

The symbol name and its file name must describe the meaning and use of a symbol as clearly as possible. Certain rules and restrictions for naming symbols are required. This lets you:

- Sort in new symbols in a correct way
- Set up default rules for selecting symbols
- Look for symbols with certain properties.

B.1.3 Dependencies

There are a number of symbols which do not follow the naming conventions described here exactly. These are mainly:

- Circuit diagram symbols with symbol classification code **k** (first character)
- Some elMaster application-specific symbols with symbol classification code **a** (first character)
- Layout diagram symbols

Those symbols are today used within hard-coded digitizer menus and specific hard-coded application functions. Therefore, you cannot rename these symbols.

This appendix is only valid if:

- The digitizer menus are not used
- The digitizer menus are adapted for new symbols.

B.2 General Naming Rules

B.2.1 General Symbol Name Conventions

Symbol names should follow certain conventions for easy identification and finding. The general rules are described in the following figures.

NOTE

The naming rules still consider the former restriction in elMaster to limit symbol names to 8 characters.This restriction is removed since elMaster 3.0 release

NOTE

All alphabetic characters must be written in practice as small characters.

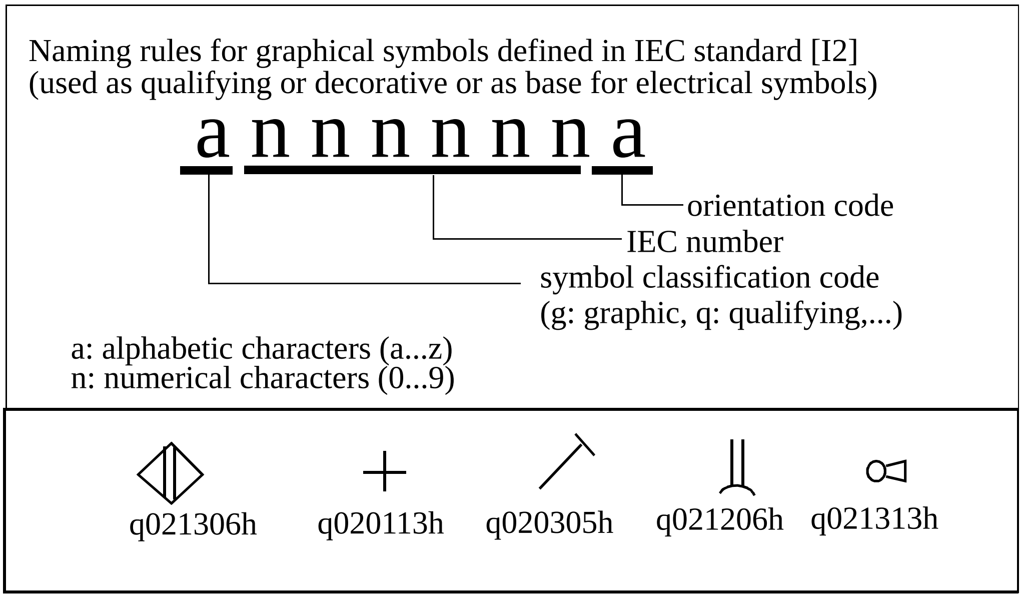

Naming rules for graphical symbols defined in IEC standard [I2]
(used as qualifying or decorative or as base for electrical symbols)
a n n n n n n a
orientation code
IEC number
symbol classification code
(g: graphic, q: qualifying,...)
a: alphabetic characters (a...z)
n: numerical characters (0...9)
q021306h
q020113h
q020305h
q021206h
q021313h

Figure B-1. Naming rule I and examples for qualifying symbols corresponding to IEC 617

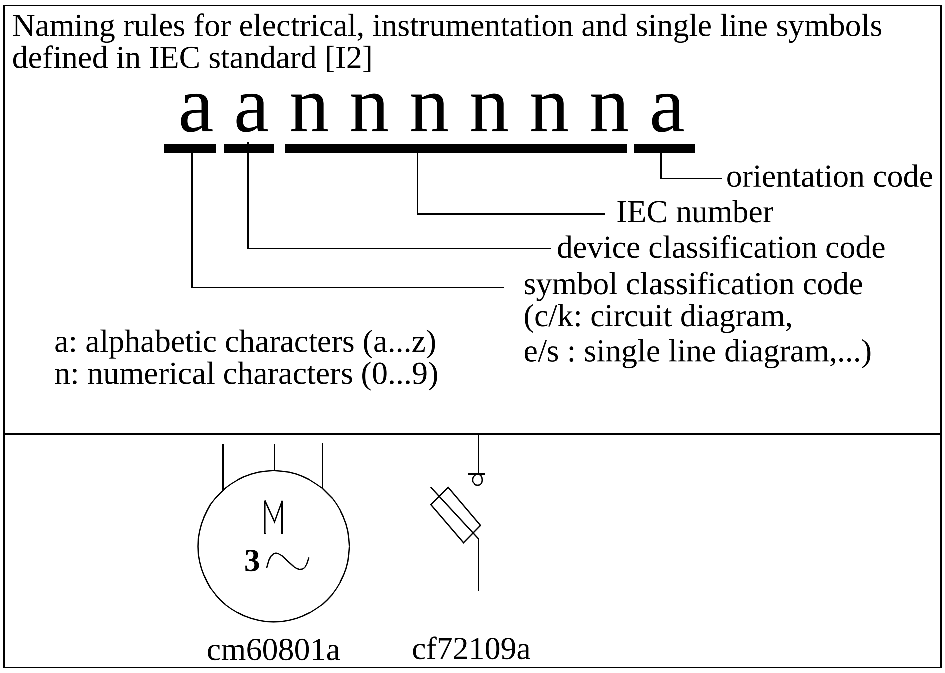

Naming rules for electrical, instrumentation and single line symbols defined in IEC standard [I2]
a a n n n n n n a
orientation code
IEC number
device classification code
symbol classification code (c/k: circuit diagram, e/s : single line diagram,...)
a: alphabetic characters (a...z)
n: numerical characters (0...9)
M
3
cm60801a
cf72109a

Figure B-2. Naming rule II and examples for electrical symbols corresponding to IEC 617

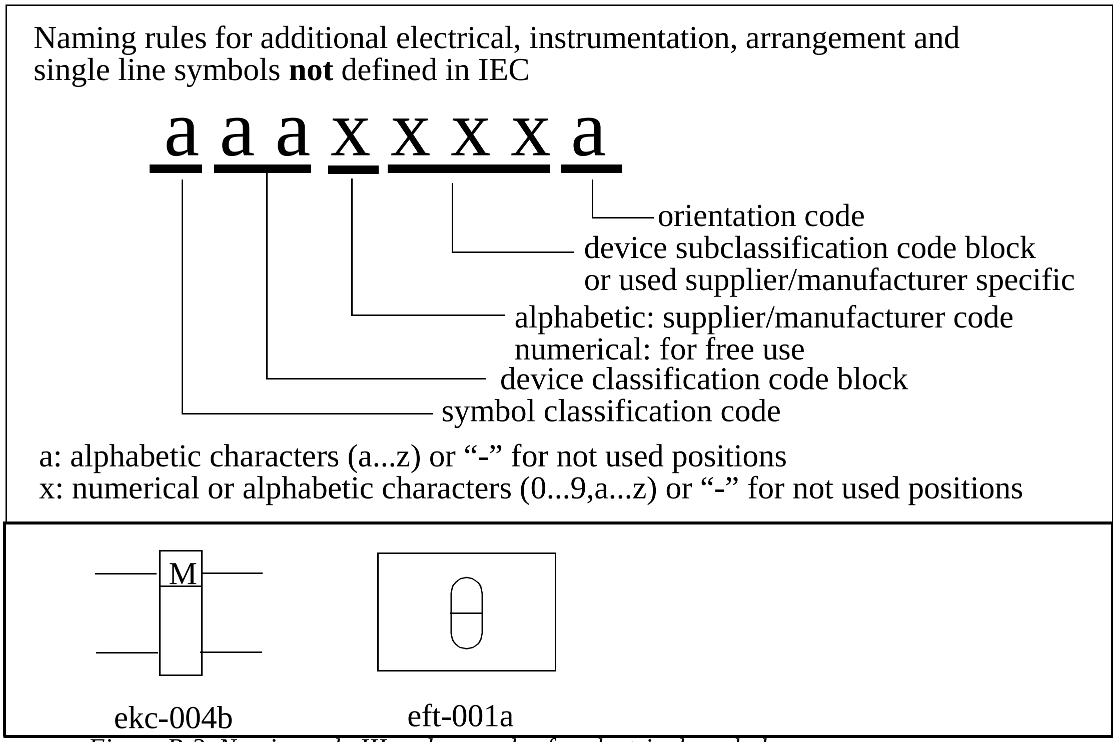

Naming rules for additional electrical, instrumentation, arrangement and single line symbols **not** defined in IEC
a a a x x x x a
orientation code
device subclassification code block or used supplier/manufacturer specific
alphabetic: supplier/manufacturer code numerical: for free use
device classification code block
symbol classification code
a: alphabetic characters (a...z) or “-” for not used positions
x: numerical or alphabetic characters (0...9,a...z) or “-” for not used positions
M
ekc-004b
eft-001a

Figure B-3. Naming rule III and examples for electrical symbols

B.2.2 Symbol Classification Code

Symbols must be designated within a first character corresponding to the following symbol classification codes:

- Electrical symbols for circuit diagrams
  Symbol Classification Code: **C/c**

NOTE

For symbols according traditional elMaster naming conventions **K/k** may also be used.

- Electrical symbols for main circuit diagrams
  Symbol Classification Code: **M/m**
- Instrumentation symbols for circuit diagrams
  Symbol Classification Code: **I/i**
- Cross-reference symbols for circuit diagrams
  Symbol Classification Code: **X/x**
- Mechanical symbols for layout/arrangement drawings/diagrams
  Symbol Classification Code: **L/l**
- Mechanical symbols for hookup diagrams
  Symbol Classification Code: **H/h**
- Block symbols for overview/block diagrams
  Symbol Classification Code: **B/b**
- Single line symbols for overview/single line diagrams
  Symbol Classification Code: **S/s**

NOTE

For symbols according elMaster naming conventions **E/e** may also be used.

- Symbols for P&I diagrams
  Symbol Classification Code: **P/p**
- Decorative qualifying symbols
  Symbol Classification Code: **Q/q**
- Application symbols (specific for all types of diagrams)
  Symbol Classification Code: **A/a**
- Pure graphic symbols for all kinds of drawings
  Symbol Classification Code: **G/g**
- General Diagram Builder symbols (for example, for formats)
  Symbol Classification Code: **D/d**

For future use, the following codes are reserved:

- Function block symbols for function charts
  Symbol Classification Code: **F/f.**

B.2.3 Device Classification Code

Within the symbol libraries for electrical, instrumentation, arrangement and single line symbols, the device classification code must correspond to DIN 40719/IEC 750 key codes. Therefore, the second character must correspond to the following conventions:

- A/a: Constructional units, device sets, electronic boards
- B/b: Sensors (non-electrical unit -> electrical unit)
- C/c: Capacitors
- D/d: Digital elements and devices
- E/e: Lamps, heaters, miscellaneous
- F/f: Protective devices, fuses
- G/g: Generators Accumulators
- H/h: Signalling instruments (lamps, horns)
- J/j: For free use
- K/k: Relays
- L/l: Inductors
- M/m: Motors
- N/n: Amplifiers, Controllers
- P/p: Measuring, indicating, testing devices
- Q/q: Power switch devices
- R/r: Resistors
- S/s: Switching devices
- T/t: Transformers
- U/u: Transmitters, Transducers (normally electrical unit -> electrical unit)
- V/v: Semiconductors and electron tubes
- W/w: Cables, other communication transmitting elements
- X/x: Terminals, plugs, sockets
- Y/y: Electrically controlled mechanical devices (actuators)
- Z/z: Filters, limiters.

The device classification code can be expanded by additional alphabetic characters. Conventions are described in Section B.2.6, Refinement of Device Classification Code Block.

B.2.4 Supplier/Manufacturer Code

The supplier/manufacturer code must be used in symbols you define yourself. Use the following conventions:

A/a: ABB

P/p: Phoenix

S/s: Siemens

T/t: Telemecanique

If a symbol is independent/neutral from a supplier/manufacturer, this should be indicated by using '-' at the corresponding position.

B.2.5 Symbol Orientation Code

For symbol using symbol classifiaction code **C, I, B, S** or **G** the last alphabetic character of the symbol name defines the orientation version of the symbol (see [S6]).

- A/a: 0^0, corresponds to definition in standard
- B/b: 90^0 turned anti-clockwise of standard
- C/c: 180^0 turned anti-clockwise of standard
- D/d: 270^0 turned anti-clockwise of standard
- E/e: version A mirrored with regard to a vertical mirroring line
- F/f: 90^0 turned anti-clockwise of version E
- G/g: 180^0 turned anti-clockwise of version E
- H/h: 270^0 turned anti-clockwise of version E.

Example: circuit diagram representation of certain relay coil with 90^0 anti-clockwise rotation sense: ck-c023b.

NOTE

Code E/F/G/H will not be relevant for new layout symbols.

Symbols using symbol classification code **K, E** or **A** follow the conventions:

- H/h: horizontal
- V/v: vertical
- U/u: upwards
- D/d: downwards
- L/l: left
- R/r: right.

For Layout diagram symbols follow the convention:

- F/f: front symbols.

B.2.6 Refinement of Device Classification Code Block

These definitions are recommendations for symbols used for electrical components and cubicle building.The definitons from[D8], *Extended item designation a*re also included and can be used as far as senseful

Only the first character of the codeblock corresponds to the device classification code.
The following characters are recommended for naming rule III (see Figure B-3).

- A: Device sets, constructional units, boards

  aa: electronic boards

  ab: mounting bars

  ac: cubicles, constructional units

  ad: transistor amplifier

  ag: device sets/groups.

  aj: IC amplifier

  am: magnetic amplifier

  ap: printed circuit board

  at: drawer unit

  ar: racks
- B: Sensors

  be: current/voltage sensor

  bf: flow sensor

  bl: level sensor

  bp: pressure sensor

  bq: locator, position encoder

  br: tacho generator

  bt: temparature sensor

  bv: velocity pickup

  bx-i: induction sensor

  bx-f: foto sensor.
- C: Capacitors.
- D: electronic boards (DCS/PLC components)

  da: general boards (controller, bus interface, power supply)

  du: I/O boards

  dx: connection units

  dg: composed symbols for device groups (for example, I/O set) di: interface/I/O symbols for DCS system

- E: lamps, heaters, miscellaneous

  el: lamp, lighting device

  eh: heating device

  ev: fan.

- F: protective devices

  fa: overcurrent protective device, instantaneuos

  fe: protective devices current/voltage

  fp-p: pilot switch pressure

  fp-f: pilot switch flow

  fp-l: pilot switch level

  fp-s: pilot switch speed

  fp-a: pilot switch acceleration

  fp-r: pilot switch rotation

  fp-t: pilot switch temperature.

  fr: overcurrent protective device, time delayed

  fu: fuse

  fv voltage monitor

- G: Generators, Accumulators

  ga: accumulator.

  gb: battery

  gf: rotating or stitic frequency converter

  gg: generator

  gs: power supply unit.

- H: Signalling instruments

  ha: audible signal device

  hl: lamp

  hh: horn.

- K: Relays

  kc: Relay coils

  kx: Relay contacts.

- L: Inductor.
- M: motors

ma: AC motors

md: DC motors.

- N: amplifiers, controllers

na: amplifier

nc: controller.

- P: measuring, indicating, testing instruments

pa: ammeter

pc: pulse counter

pj: watthour meter

pp: indicating, testing panel instrument.

ps: ecording instrumentr

pt: clock, elapsed hour meter

pv: voltmeter

- Q: power circuit devices

qf: circuit breaker

qm: motor breaker

qs: disconnector

qb: breakers.

- R: resistors
- S: switches

sp: push-buttons

sr: rotary switches

sc: timer clock

- T: transformer windings
- U: transducer and transmitters

ue: for electrical unit

uf: flow transmitter

up: pressure transmitter

ut: temperature transmitter

- V: semiconductors

vt: transistor

vy: thyristor

- W: cable symbols

- X: Connective devices
  xt: terminals
  xp: plugs
  xs: sockets
- Y: Actuators
- Z: Filters, limiters
  zc: C filters
  zd: Diode limiter
  zx-rc: R/C filters
  zx-rd: R/Diode limiter.

B.2.7 Symbol Numbering Concerning IEC 617/DIN

The following list gives only an overview, how symbols are organized within IEC 617

02: Symbol elements, qualifying symbols and other
02-01: Frames, lines, shields
02-02: Current, voltage, potential
02-03: Variability
02-04: Direction of force or motion
02-05: Direction of flow
02-06: Operational Dependence on characteristic Quantity
02-07: Types of material
02-08: Effect or dependence
02-09: Radiation
02-10: Signal waveforms
02-11: Printing, perforation and facsimile
02-12: Mechanical controls
02-13: Operation devices and methods
02-14: Control by non-electrical quantities
02-15: Earth and frame connections, equipotentiality
02-16: Ideal circuit elements
02-17: General application/Misc. symbols
03: Conductors and Connecting Devices
03-01: Conductors
03-02: Terminals and connection of conductors
03-03: Connecting devices (plug, socket)
03-04: Cable fittings
04: Passive Components

04-01: Resistors
04-02: Capacitors
04-03: Inductors
04-04: Symbol elements Ferrit cores and magnetic storage matrices
04-05: Ferrit cores
04-06: Magnetic storage matrices

04-09:
05: Semiconductors and electron tubes
05-01:

05-016:
06: Production and conversion of electrical energy
06-01: Qualifying symbols for winding interconnection
06-02: Internally connected windings
06-03: Elements of machines
06-04: Types of machines
06-05: Direct current machines
06-06: Alternating current commutator machines
06-07: Synchronous machines
06-08: Asynchronous machines
06-09...13:Transformers and reactors
06-14: Power converters
06-15: Primary cells and accumulators
06-16: Power generators
06-17: Heat sources
06-18: Power Generators
07: Switchgear, control gear and protective devices
07-01: Qualifying symbols of Contacts
07-02...06:Contacts
07-07...11:Switches
07-12...13:Complex switches
07-14: Block symbols for motor starters
07-15: Electromechanical relays (relay coils)
07-16...18:Measuring relays and related devices
07-19...20:Proximity and touch sensitive devices/switches
07-21: Fuses
07-23: Gaps and arrestors
07-24: Igniters and flag indicators

08: Measuring instruments, lamps and signalling devices
08-01, 02: Indicating instruments
08-03: Recording instruments
08-04: Integrating instruments
08-05: Counting devices
08-06: Thermocouples
08-07: Telemetric devices
08-08: Electric Clocks
08-09: Misc. measuring elements and instruments
08-10: Signalling instruments (Lamp, horn, siren, buzzer)
09: Telecommunications: Switching and peripheral equipment
09-01...04: Switching systems and equipment
09-05...07: Telephone, telegraph and data equipment
09-08...10: Transducers, recorders and reproducers
10: Telecommunications: Transmission
10-01...02:Telecommunication circuits
10-03...06:Antennas and radio stations
10-07...11:Microwave technologies
10-12...20:Misc. block symbols
10-21...22:Frequency spectrum diagrams
10-23: Fibre optics, Transmission lines
10-24: Fibre optics, Transmission devices

B.3 Application specific Mapping of Symbols to Library (sub)directories

B.3.1 Circuit Diagram Application

Subdirectories, including symbols for circuit diagrams, are all located below directory

...\cadlib\<symbollibrary>\blksld\<symbolgroup>\

B.3.1.1 Electrical and Instrumentation Symbols

First character:

c: for conventional circuit diagram symbols according naming convention described in this appendix (see [I2])
i: for instrumentation circuit diagram symbols (with additional attributes) (see also [S2]).
k : for circuit diagram symbols according naming konventions described in elMaster Design Manual

For 2..3 character is recommended to use as far as possible definitions in[D8], *Extended item designation*.

NOTE

Customer specific symbols with customer code at the 3rd position may not follow these rules in the following positions.

Structuring/naming conventions (2...5 character) in addition to [D8] and mapping to subdirectory

ag*: composed symbols for general device sets/groups-> cgroups

b*: sensors -> sensors

c*: capacitors -> passcomp

da*: general DCS boards (controller, bus interface, power supply)-> units

du*: DCS I/O boards-> units

dx*: DCS connection units-> units

dg*: composed symbols for device sets (I/O set)-> cgroups

di*: interface/I/O symbols for DCS system-> i_o_unit

e*: lamps, heaters-> passcomp

fe*: protective devices current/voltage-> protect

fp*: pilot switches > pilotsw

g*: generators, accumulators-> source

h*: signalling instruments-> signal

kc*: Relay coils-> coils

kx*: Relay contacts-> contacts

l*: Inductors -> inductor

m*: motors -> motors

n*: amplifiers, controllers (not DCS)-> units

p*: measuring, indicating, testing instruments-> instrum

q*: power circuit devices-> pow_circ

r*: resistors -> passcomp

s*: switches -> switch

t*: transformer windings-> transf

u*: transducer and transmitters-> transduc

v*: semiconductors-> semicond

w*: cable symbols-> conduct

x*: terminals -> connect.

y*: actuators -> actuator (instrum, if not available)

z*: filter elements/limiters -> filters.

B.3.1.2 Cross-reference Symbols

First character:

x: for cross-reference symbols

Structuring/naming conventions (2...4 character)to subdirectory

kx*:Relay contacts -> xref.

B.3.1.3 Miscellaneous Symbols

The naming conventions for these symbols are defined now only for the first character.

Structuring/naming conventions (1st character)to subdirectory

s: single line symbols-> single

q: qualifying symbols (first character)-> qualif

Remark: Followed by identification number concerning IEC code

a: application symbols (used within functions, must not be renamed!) -> applik.

B.3.2 Layout Diagram Application (Arrangement)

Subdirectories, including symbols for layout diagrams, are all located below directory

...\cadlib\<symbollibrary>\blksld\<symbolgroup>\

B.3.2.1 Symbols for Arrangement

First character:
l: for layout symbols used in layout/arrangement drawings

In the following text the appended device classification code (block) is specified and the mapping to file system directories.

Structuring/naming conventions (2...3 character)to subdirectory

ab: mounting bars-> bars

ac: cubicles, constructional units-> cubicle

ag: device sets/groups-> groups

ap: plate symbols-> plates

ar: racks -> cubicle

da,du: boards for DCS/PLC system-> plc

dx: connection units-> plc

el: lamps -> lamp

f: protective devices-> fuse

ga: accumulators-> msc-cub

hl: signal lamps -> lamp

k*: Relays -> auxrelay

n*: amplifiers, controllers (not DCS/PLC)-> msc-cub

p*: general measuring, indicating, testing instruments -> instr

pp: indicating, testing panel instrument -> msc-pan

qs: power switches-> contact

qb: breakers -> breaker

sp: push-buttons-> pushbutt

sr: rotary switches-> rotsw

sc: timer clock -> addition

t*: transformers -> msc_cub

u*: transducer and transmitters (cubicle mounted)-> msc-cub

xt: terminals -> terminal

xp: plugs -> terminal

xs: sockets -> (base).

B.3.2.2 Miscellaneous

First character: ‘l’

Structuring/naming conventions (2...3 character)to subdirectory

’nnn’mm: cable ducts-> ducts

-p: misc. symbols for panel assembly-> msc-pan

-c: misc. symbols for cubicle internal assembly-> msc-cub

-a: misc. symbols for additional accessory-> msc-add

-x: symbols for misc. accessory (for example, clock)-> addition

-r: Symbols for current and earth rails-> rails.

B.3.2.3 Recommended Conventions for Not Yet Considered Layout Symbols

First character: ‘l’

Structuring/naming conventions (2 character)to subdirectory

b: sensors -> lsensor

c: capacitors -> msc-ele

l: Inductors -> msc-ele

r: resistors -> msc-ele

v: semiconductors-> msc-ele.

B.3.2.4 Symbols for Application Specific Symbols

First character: 'a'

Structuring/naming conventions (2nd character)to subdirectory

m: ruler symbols for layout -> ruler

x: misc. symbols for special applications -> applik

h: hole punches -> holes

l: labels/markers-> label.

B.3.3 Drawing Application

B.3.3.1 Graphic Symbols

Structuring/naming conventions (1st character)to subdirectory

G/g: pure graphical symbols (first character).

B.3.3.2 Single Line Symbols (for Overview Diagrams)

Symbols to be available are described in [S2].

First character **s**:

Structuring/naming conventions (2-3 character)to subdirectory

ag: groups, composed symbols-> ogroups

b*: sensors -> oinstrum

c*: capacitors -> opasscom

f*: protective devices-> oprotect

h*: signalling instruments-> oinstrum

m*: motors -> opower

n*: amplifier/controllers-> oinstrum

p*: indicating instruments-> oinstrum

q*: power circuit devices-> opower

r*: resistors -> opasscom

t*: transformers -> opower

u*: transducers -> oinstrum.

B.3.3.3 Block Symbols (for Overview Diagrams)

First character is **b**

Structuring/naming conventions (2nd character)to subdirectory

(not yet specified)-> oblock.

B.3.3.4 Miscellaneous Symbols (for Overview Diagrams)

Structuring/naming conventions (1st character)to subdirectory (net q: Qualifying symbols-> oqualif

NOTE

See qualifying symbols for circuit diagrams; for special qualifying symbols needed for instrumentation see [D5].

p: P&I diagram symbols used in single line-> oprocess.

Appendix C Guideline for Building Symbols

C.1 Introduction

C.1.1 Background

In symbol blocks, you can specify the following:

- Which static graphic symbols are included
- Which attribute definitions are related to the symbol
- Which terminals (connect nodes) are related to the symbol
- What is the category of the symbols
- What is the meaning/description of the symbol
- What is the behaviour when inserting the symbol

The graphical representation is separated between different orientation views/variants corresponding to the rotations, in which the symbols can be used within circuit diagrams. If this is the same, symbols must be specified several times.

C.1.2 General Conventions

The graphic part, the attributes and the terminals of the symbols are included in the part stored on the file system as AutoCAD files in `*.dwg` file format. Additionally the descriptive part and the behaviour rules are stored in a symbol registry database.

How to keep this together and how to exchange this between different installations is described in Appendix E

Conventions concerning use of layers for circuit diagram and layout diagram symbols are described in the user's manual elMaster Design, chapter 4.

C.2 Circuit diagram symbols

C.2.1 Reference to standards

The graphic part of conventional circuit diagram symbols according to IEC and DIN must be done according to [I2]. More complex symbols may be composed also by several elemental symbols.

Symbols specific to instrumentation and control according to DIN are also described in [D5].

Symbols specific to instrumentation and control according to ISO are also described in [S2].

Principles and rules according to ISO/IEC are described in [S5].

Principles and rules according to DIN are described in [D6] and [D2] T1000.

C.2.1.1 Standard Design Guidelines for Symbols

Design Guidelines for Symbols

– ISO/IEC11714-1	Chapter 6.5, Grid, module Chapter 6.14.5, Minimum distances Chapter 8, Versions of graphical symbols
– ISO/IEC11714-2	Chapter 6.2, Versions of graphical symbols Chapter 6.3, Scaling Chapter 6.4, Moule sizes in reference libraries Chapter 6.8, Connect nodes Chapter 6.10, Connect node identification Chapter 6.14, Defaulted location of identifying and descriptive block Chapter 6.18, Reference symbol name

Standards for Symbol Library Content

- DIN EN 60617, Graphische Symbole für Schaltpläne
- IEC 617, Graphical symbols for Diagrams
- IEEE315/ANSI Y 32.2
- ...

C.2.2 Graphical design principles

General graphical conventions:

Grid system (Module) for format size <= A3
M=2.5 mm for IEC symbols
M=2 mm for DIN symbols
(See also Design Guidelines for Symbols -ISO/IEC11714-1, Chapter 6.5, Grid, Module)

- Properties of graphics in symbols:
  - Thickness: (d) is 0.1xM (**Note**: for main circuit lines is used d = 0.2xM)
  - Linetype: BYBLOCK
  - Layer: 0
  - color: BYBLOCK
- Minimum distance between graphic lines or graphic lines and text = 2 x d
  - 0.5 mm for IEC
  - 0.4 mm for DIN

  Note: 1 mm resp. 0.8 mm used in main circuit lines

  (See also Design Guidelines for Symbols -ISO/IEC11714-1, Chapter 6.14.5, Minimum distances)
- Minimum height (h) for attributes = 1xM
  - IEC: 2.5 mm
  - DIN: 2.0 mm

- Minimum distance between text/attributes lines >= 1.3xh
  Recommended values are:
  - IEC symbols: 3.25 mm
  - DIN symbols: 3 mm
- Specific use of some layers for graphics and attributes:
  - Layer **0** : normally used within symbol definition, content will be placed on active layer during inserting symbol in diagrams (will normally be layer **SOSED_CIRCUIT**)
  - Layer **SOSED_CIRCUITOFF** : should be used for attributes, which should not be displayed normally (often relevant for remark texts)
  - Layer **SOSED_DECORATIVE**: should be used for lines within composed symbol blocks, which shall not be interpreted as connecting lines
- It is recommended that you block graphical symbols before adding attributes.

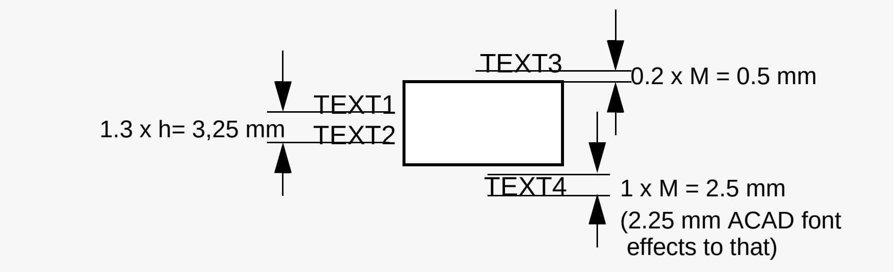


Figure C-1. Minimum sizes and distances according IEC for M = 2.5 mm

C.2.3 Connection Point and Reference Point Definitions

Connect nodes (defines connection point) provide on one hand side the connectivity of symbols for electrical connecting lines and handle terminal designations on other hand side..

The reference point corresponds to that point, which is used later to insert the symbol into the diagram. Therefore, it is often also called the insertion point.

Each electrical connect node defined for a symbol block consists of two parts:

- The attribute related to the symbol block to handle the terminal designation/number. The TAG name of the attribute has to follow the naming conventions 'na' (a=(A,B,...Z); n=(1,2,3,....9).
  The number 'n' must be unique for all connection points of a symbols.
  It is not allowed to skip numbers in the consecutive sequence (wrong: 1,2,4,5)
- the NOD block representing the connect node itself, to which connecting lines can be assigned or which break up connecting lines automatically. The "node" name has to follow the naming conventions 'an'.

Recommended letter for connect nodes t is "A"
(examples: A1, A2, A3)

Connect nodes must have a distance of n x 2M

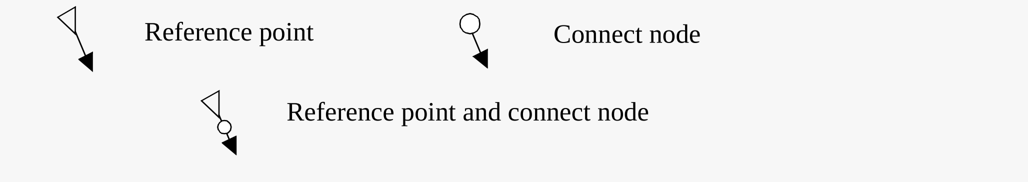


Figure C-2. Symbols used to describe reference points and connect nodes

For internal numbering of connect nodes you have to follow the rule according to [S5].

- First connect node is defined according following priority rule
  1) most top position
  2) most left position
- The other connect nodes are numbered sequentially in clockwise sense
- The reference point is identical to the first connect node
- The reference point is defined for a symbol in basic orientation (as symbol is shown for example in IEC 617 standard) and remains independent from its rotation

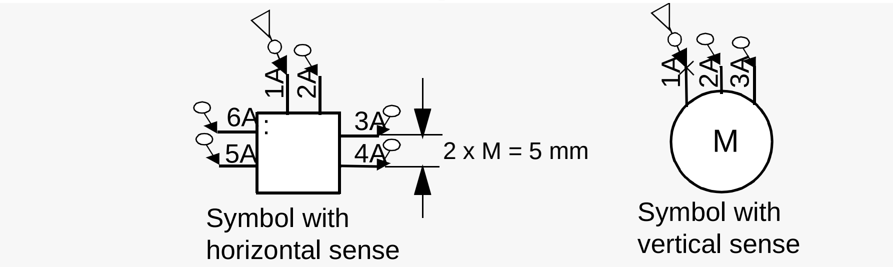


Figure C-3. Reference points and connection point numbering for symbols

The positioning and orientation of terminal designation attributes must be according [S5]:

- horizontal and above connecting lines for horizontal connecting lines
- vertical and left to connecting lines for vertical connecting lines

C.2.4 Attribute Definitions

There are some attributes defined with specific handling within the system, also towards the database

- Reference/Item Designation attributes
  the attributes **ID1, ID2, ID3, ID4** are used to display reference designations and are normally used for all type of symbols.
  There is no fix relation, which type of reference designation will appear within which attribute. This mapping is floating dependant from number and type of reference designations used at symbol.
- Remark attributes
  the attributes **REM1** and **REM2** are used as remark fields. It are typically used to display technical data like voltage, power, current......
  Data can be exchanged in both direction between symbol and linked object in database
  Note: be careful with adding remark attributes to all type of symbols, because this might

inflate your diagram with remark texts when you update your diagram from database!

- Denomination attributes
  the attributes **DENOM1,DENOM2** and **DENOM3** can be used to handle object denominations (descriptiv names)
- Article Designation attribute
  the attribute **ARTDES** can be used to display the article type related to the object. This attribute can only be updated from database from attribute **Article Type 1** within article library
- Free Designation attribute
  the attribute **ID_FREE** can be used for a free designation of an object, which needs not to follow any naming rules like for reference designations.
  Examples are : Cable number, Instrument Id, Signal name related to OCS I/O channels,....
  Attribute value can be exchanged in both direction between symbol and linked object in database.
  Note: if no other reference designation is used at the symbol, the free designation is used to identify the object in the database.
- Absolute Address attribute
  the attribute **ID_ABS** can be used to display the OCS item designation (absolute address). This is typically used within I/O channel symbols.

C.2.5 Symbol Categories

The symbol category references to the kind of object (device, device function, ..) it shall represent in the diagram. It has influence to

- which category of object related to the symbol will be created in the database
- which cross reference symbols will be mapped to each other
  (only symbols with same category will be mapped to each other)

The list of predefined symbol categories and its default mapping to object categiories in database is described in Appendix E

C.2.6 Symbol Types

The Symbol Blocks represent EDIB database objects in the diagrams. Symbol blocks can provide specific functionality by classifying it according different predefined symbol types.

- General Symbol
  for most kind of electrical devices, which are exactly represented by one symbol within circuit digrams. Examples are resistors, lamps, fuses,...
  It must not have any specific symbol type defined
- Main Symbols
  for electrical devices having additional functions/parts shown in detached manner by use of cross reference symbols
  An example for a main symbol is a coil of a relay, because the conctacts of a relay can be used in detached manner within circuit diagrams.

The symbol type for a main symbol must be set to **ED_MAIN**

- Cross reference symbols
  - reference symbols
    for functions/parts of an electrical device shown in detached manner with back reference to its main symbol. Typical examples are contacts of a relay.
    There must not to be defined any symbol type.
  - referencing symbols
    for referencing functions/parts of an electrical device. The referencing symbols are placed attached to the main symbol. It will not be connected by connecting lines.

    The symbol type of a referencing symbols must beset to **ED_XBLK**

Note: to get the cross reference handling working, the reference and referencing symbol must have same symbol category!

- Terminal Symbols
  are used to define terminals related to terminal bars, junction boxes,...
  It have typically 2 connect nodes (one for each side), but only one terminal designation
  The symbol type of terminal symbols must be **ED_TERMBLK**.
- Signal reference Symbols
  are used to create cross references between interrupted connecting lines via signal designations
  - **general** reference: used to create continuous signal references normally from previous to next sheet
    symbol type is ED_SIG
  - signal s**ource** reference:used to create signal references to several signal sinks
    symbol type is ED_SIGSRC
  - signal **sink** reference: used to create signal back reference to one source signal
    symbol type is ED_SIGSINK

C.2.6.1 General and Main symbols for devices

General symbols represent devices, which need only be represented by one symbol within circuit diagrams.

Main symbols represent devices, which can have additions functions/parts used in detached manner in circuit diagrams

Necessary attributes:

- Item Designations (ID1 ... ID4)
- Terminals Designations (like 1A, 2A,...), one is needed for each connect node

All other attributes can be used optionally

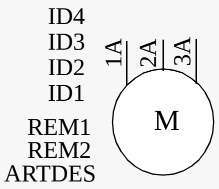


Figure C-4. Examples for motor symbol according IEC

Main symbol must have set Symbol type to **ED_MAIN**.

C.2.6.2 Reference symbols for device functions/parts

Reference symbols are used for functions/parts of an electrical device shown in detached manner with back reference to its main symbol.

Necessary are the attributes:

- Item Designation (ID1 ... ID4)
- CREF: Cross reference attribute, will reference to the main symbol
- Terminals Designations (like 1A, 2A,...), one is needed for each connect node

All other attributes can be used optionally

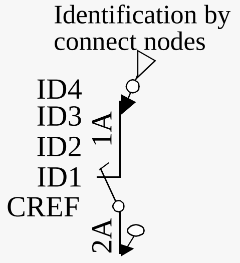


Figure C-5. Examples for daughter symbols

C.2.6.3 Referencing symbols for device functions/parts

For cross-reference handling for each used function of a multi function device must be placed a cross-reference symbol assigned to the Main symbol as counter part.

A “Cross-reference symbol block” should include only the necessary attributes:

- ID1 ... ID4: attributes for Item/Reference Designation
- Terminals Designations (like 1A, 2A,...), one is needed for each terminal
  Note: there must be used any connect node symbols
- REF1 ... REFn : Cross reference attributes, will reference to the terminals of reference symbols

The symbol type of a referencing symbols must be **ED_XBLK**

The reference and referencing symbol must have same symbol category!

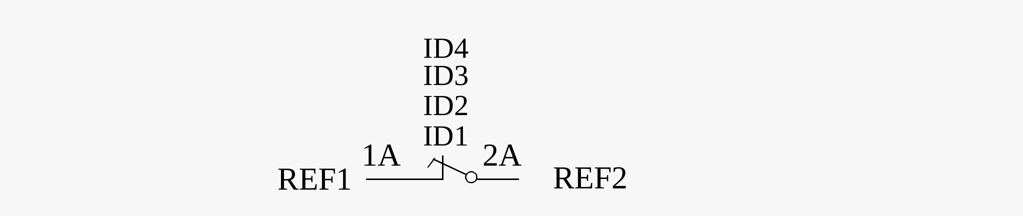


Figure C-6. Examples for cross-reference symbol

NOTE

The “referencing symbol blocks” may optionally already be grouped together with the Main symbol block definition (so the referenced Main symbol is originally stored already as composed symbol block).

C.2.6.4 Terminal symbols (2 side)

Definitions:

Terminal or better **terminal block** means physically a component related to a terminal bar.

Necessary for a terminal symbol are the following attributes:

- ID1 ... ID4 : Item Designation (Identifying designation of BAR object)
- *A: Terminal No.
- two connect node definitions (A1, A2) by use of **NOD** symbol

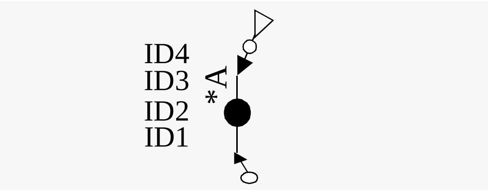


Figure C-7. Examples for terminal symbol according IEC

Note: sometimes the insertion point is defined in the mid of the symbol, but this is not according definitions in IEC standard

The symbol type of a terminal symbol must be **ED_TERMBLK**.

The symbol category of a terminal symbol should be **CONNECT.**

C.3 Layout symbols

C.3.1 Graphical design principles

- Symbols are drawn with 1:1 scaling
- For use of attributes layers for graphics see reference manual *Electrical Diagram Builder, Create your own blocks*

Appendix D Guideline for Building Composed Symbols/Typical Diagrams

D.1 Introduction

D.1.1 Background

Composed Symbols mean symbols available within symbol library but representing ready made parts of a diagram. It are exploded during insert into its single elements and will loose therefore its relation to the composed symbol definiotion in the library it were inserted from.

Elements within a composed symbol can be:

- individual symbols (which will be linked to objects in database)
- boundary frames
- preset designation (reference - , free -, terminal designations) at symbols/boundary frames
- preset descriptive attributes (remarks, denominations) at symbols/boundary frames
- connecting lines (for circuit/connection diagrams)
- pure graphic

Typical diagrams means ready made diagrams including elements as already described for composed symbols and including format in addition.

D.1.2 Principles in Designation Handling

The principles of designation handling must be considered when building complex composed symbols or even ready made typical diagrams.

The common reference designations on sheet level will be set automatically when including circuit diagrams in Advant Objects within Structure Builder. So it is recommended to build typical diagrams in a way, that this is the only information which must be adapted for using the typicals.

The reference designations must be entered and are build according rules configured for a project. The default configuration is according IEC 750. Those rules and how it are used by the system is described in the following examples.

Concatenating reference designations

Reference designations are concatenated hierachically with common designations and according the nesting of symbols within boundary frames.

- reference designations of same type are concatenated
- product reference designations are build according the priority rule:

1. with common product reference designation (if exists)

2.with common function reference designation (if exists)

3.with common location reference designation (if exists)

- signal designations are build according configured priority rule. It can be configured to use
  - function reference designation (default)
  - location reference designation.

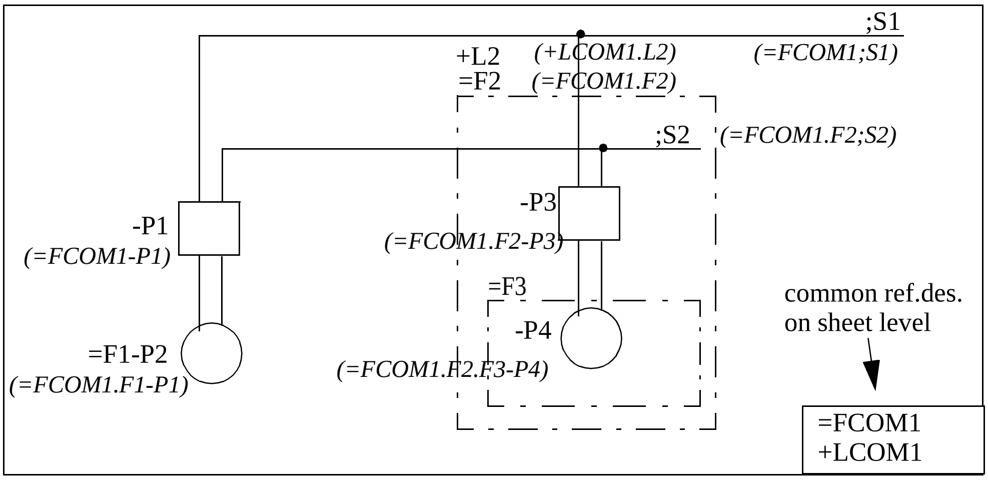


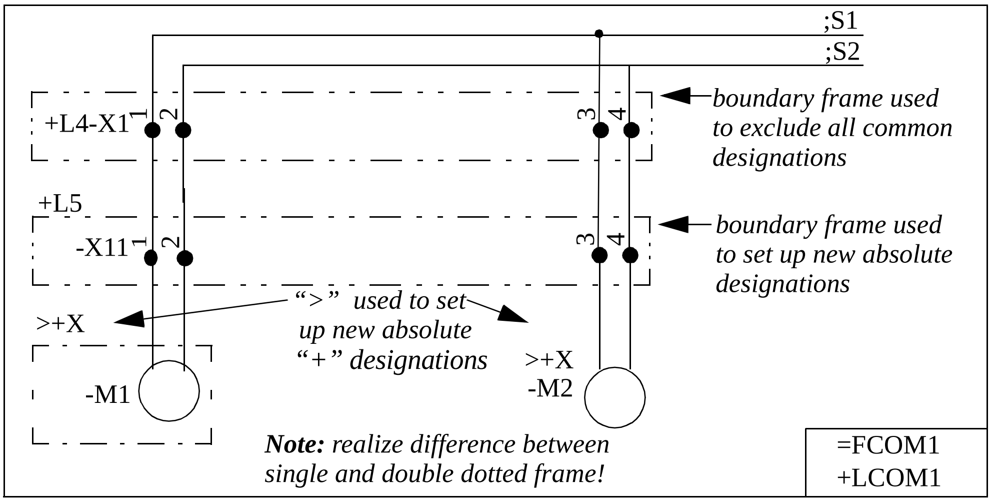
Figure D-1. Example for a diagram incl. hierachicle reference designations

Defining exceptions from hierachicle concatenation

Sometimes it is needed to avoid the hierachicle concatenation with designation given on common (upper) level.

There exist two possibilities:

- use double-dotted boundary frame to exclude all designation
- use “>” to exclude specific designation


;S1
;S2
+L4-X1
1
2
3
4
boundary frame used to exclude all common designations
+L5
-X11
1
2
3
4
boundary frame used to set up new absolute designations
“>” used to set up new absolute “+” designations
>+X
-M1
>+X
-M2
=FCOM1
+LCOM1

Note: *realize difference between single and double dotted frame!*

Figure D-2. Example for a diagram incl. hierachicle reference designations

Use of upper/local designations

Within designation handling is distinguished between

- *Upper designations*
  An upper designation from a certain object point of view identifies the parent object in the corresponding structure
  Example: in figure below for item **-P2** are **=FCOM1.F1** and **+LCOM1.L3** used as upper designations
  It are typically defined as common designation on sheet level or via boundary frames. But is also possible to include it directly at symbol and turn it to “Upper”
- *Local Designation*
  those are individual for the symbol/object and are normally be used within identifying designation (designation, which identifies object unambiguously)
  Example: the product reference designation **-P2** is defined locally and build together with

a common designation **=FCOM1.F1** the identifying designation **=FCOM1.F1-P2**.

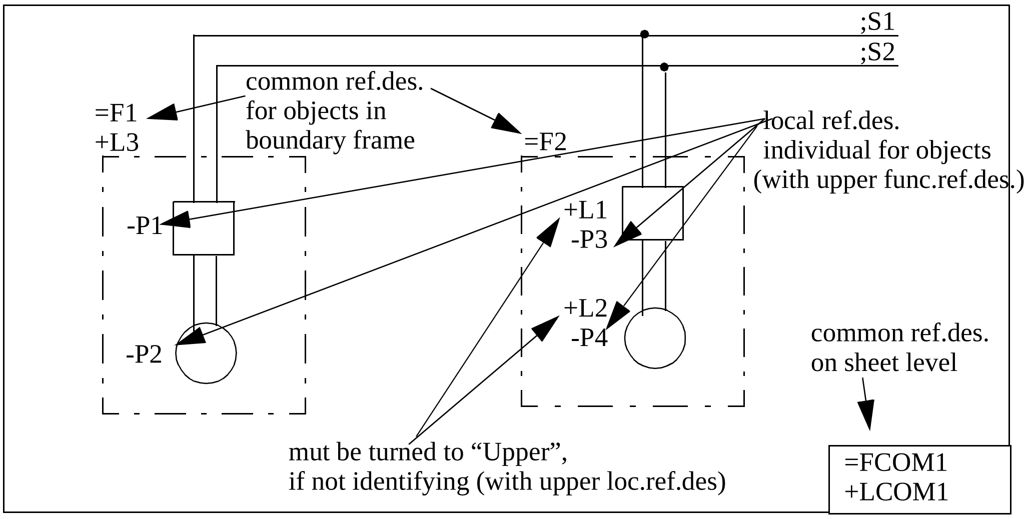


Figure D-3. Example for a diagram incl. hierachicle reference designations

NOTE:

Be aware, that all common designations are inherited to nested symbols, if it are not explicitely excluded. This might lead to unexpected result for objects drawn in detached manner (like contacts of relay) within diagrams with different set of common reference designations!

In the figures below are shown two examples for ready made diagrams.

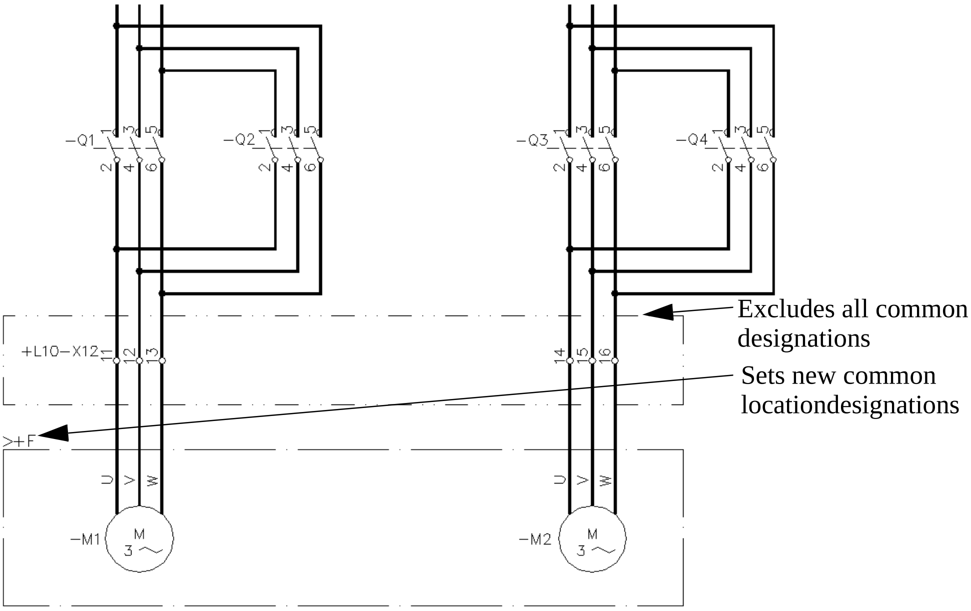
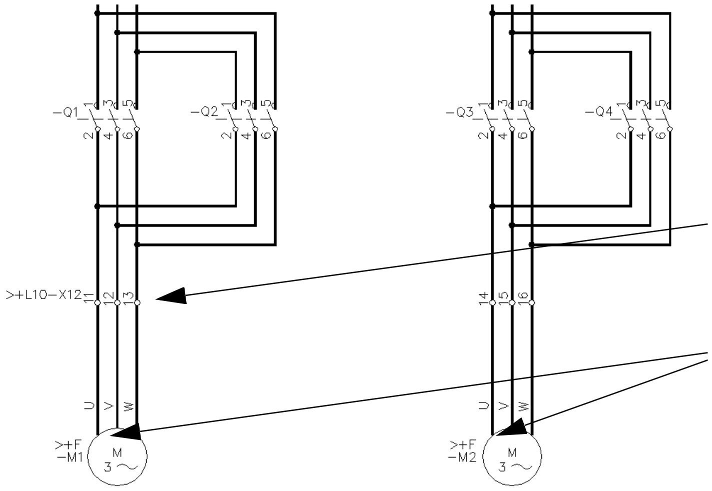


Figure D-4. Recommended way to deal with common designations



Common function
ref.des. will be inherited
(normally not wanted)

Location ref.des. is local
and will be used also to
identify object
(symbols might be linked
to wrong objects)

Figure D-5. ***Not*** *recommended way to deal with designations*

D.2 Composed Circuit Diagram Symbols

D.2.1 Function oriented Symbols

The function oriented approach is the most common within circuit diagrams.

This means, designations within composed circuit diagram symbols are prepared to be concatenated later with common function reference designations.

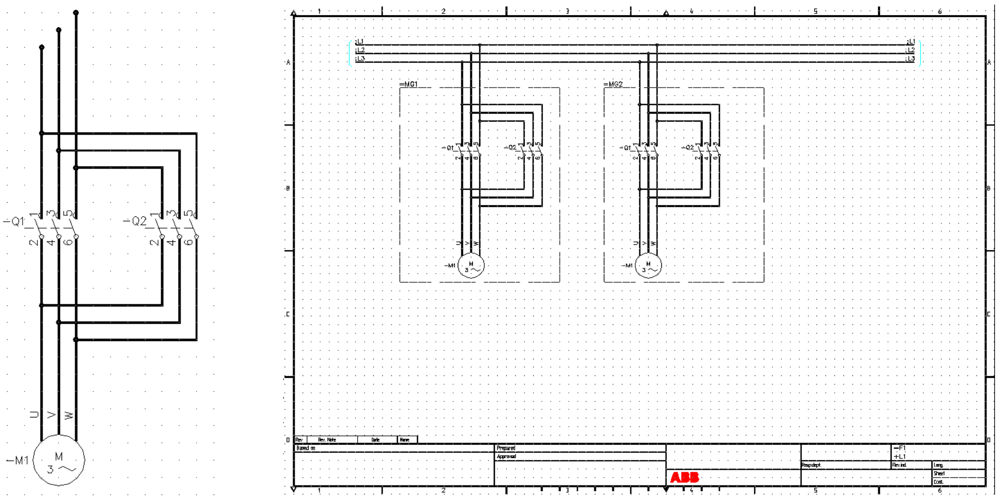


Figure D-6. Definition and use of a composed symbol

It should be avoided

- to predefine already supplementary designations like location reference designations

- to predefine already objects not belonging to the function
  Example: terminals related to a marshalling bar
  It is easier for example to add later terminal symbols and give terminal designations when wiring is done. If it are predefining already within composed symbol, all designations must be known and edited immediately when using such a symbol.
  Exception: Terminal numbers can be adapted later in an easy way

D.2.2 Product oriented Symbols

Composed symbols can also be made up in product oriented way.

There are two possible approaches depending from the needs

1. use a boundary frame to group elements of a product

   This is the recommended way, if elements included in product can be identified by supplementary product reference designations in a nested way.

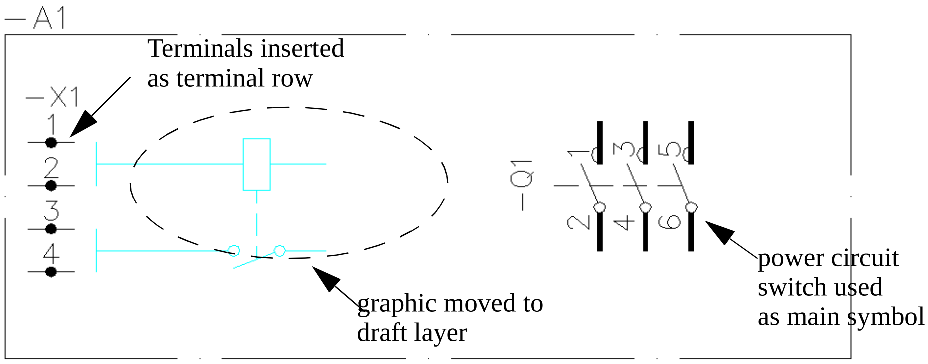


Figure D-7.

2. make up composed symbols in attached manner
   it is also possible to build up composed symbols for a product by attaching them via mechanical links. This requires, that symbols are prepared for this by adding a connect node. The figure below shows a composed symbol block for relay incl. its contacts drawn

in attached manner, first in normal presentation and then with visible electrical and mechanical connect nodes

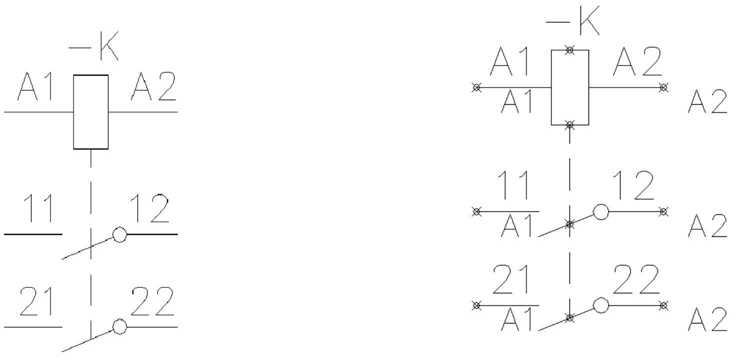


Figure D-8. Example for a relay drawn in attached manner

D.2.3 Cross Reference Symbols

In opposite to use of a product oriented approach by drawing symbols in attached manner, it is also possible to draw symbols in detached manner. This supports a more function oriented approach.

To find the single parts of a component drawn in detached manner (for example the contacts of a relay) in an easy way, you can use the cross reference functionality

For easy application purpose it is recommended to prepare composed symbols including the main symbol and its related referencing symbols.

The main symbol and its related referencing symbols must be grouped together. Therefor choose **Modify | Cross references | Connect symbols** from elMaster Design menu and select all symbols before you create from it a composed block in the block library

The typical example is a relay coils with its contact tree, which will later show the cross references to all contacts used in detached manner

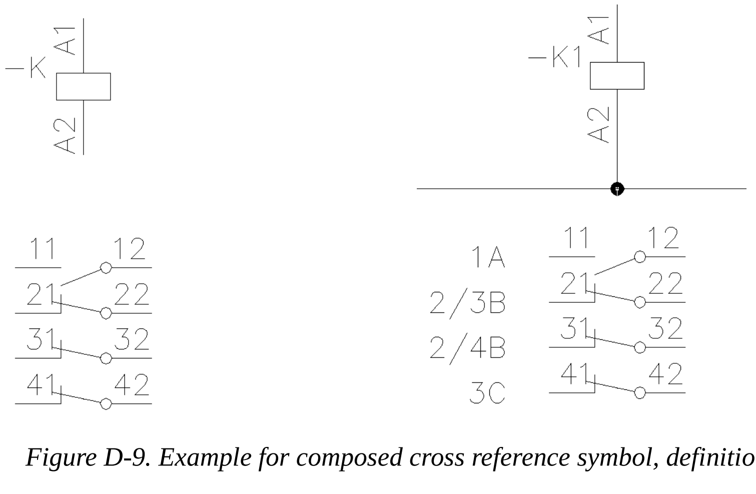


Figure D-9. Example for composed cross reference symbol, definition and in use

D.2.4 Building Black Box Symbols

Black box symbols can also be prepared as composed symbols using the black box functionality of elMaster design.

A black box works similar to a boundary frame but with following differences:

- a black box will be linked to only one object in database
- all symbols and therefore all its terminals included in the black box belong to the object the black box is linked to
  Therefore terminal designations must be unique within black box
- additional reference designation edited at symbols included in black bow will not be considered
- Cross reference handling will not work together with black box symbols

So for example the black box functionality can be used to avoid the 9 terminals restriction for symbols

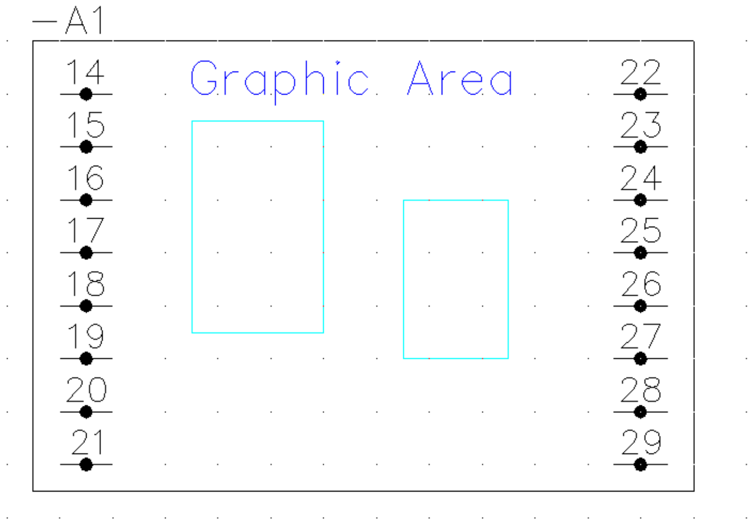


Figure D-10. example for a composed symbol using a black box

D.3 Typical Circuit Diagrams

Typical diagrams and composed symbols are intended to be build for easy reuse.

This depends much on use of reference designation system.

So you will have the most benefit, if the hierarchy within diagrams (common for sheet -> boundary frame(s) -> symbols) corresponds to the hierachy of reference designations

D.3.1 Sceletons for Circuit Diagrams

Sceletons in this context means diagram typicals inc. format and additionally enriched with some sectioning to indicate, where to add which kind of information (symbols, connecting lines,...)This is a typical approach for loop oriented I/O diagrams

So the different types of boundary frames can be used to mark the areas and give them its specific behaviour concerning handling of reference designations

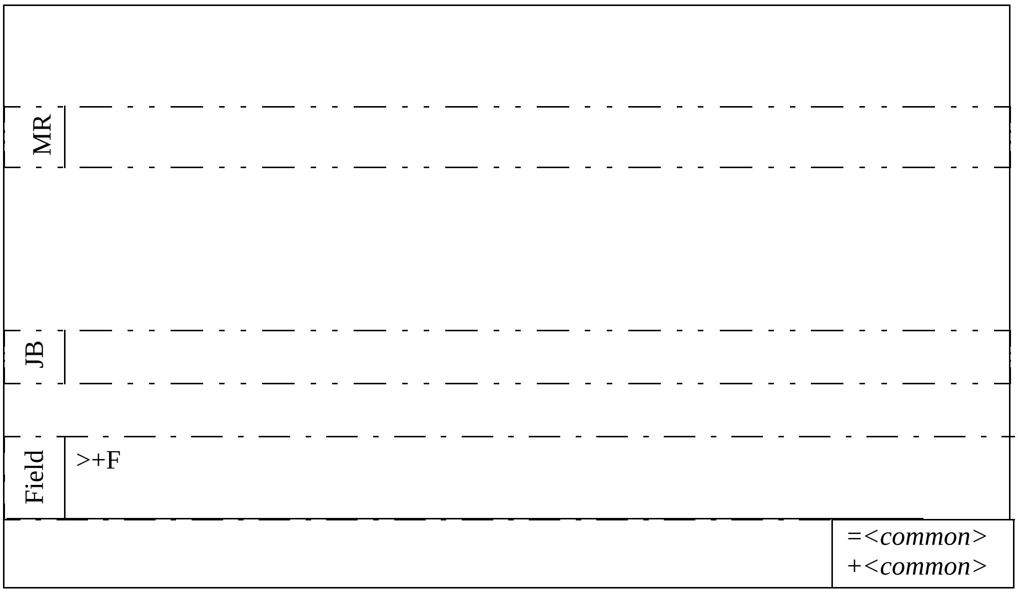


Figure D-11. Example for a sceleton incl sections for field devices, junction box level and marshalling rack level

D.3.2 Function oriented Circuit Diagrams

The example below shows a simple approach of a typical circuit diagram, which can just be used by adding a common function reference designation

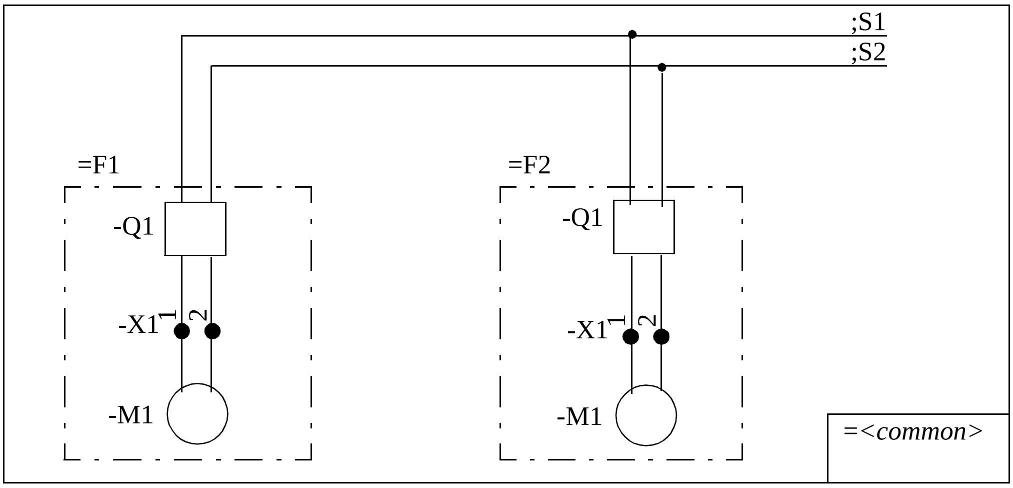


Figure D-12. Example for a diagram incl. only hierachicle reference designations

It is possible to prepare some additional items which are fix, so for example

- fix loaction designations (like **+X** for all field located objects)
- fix areas for adding terminals identified in location oriented way

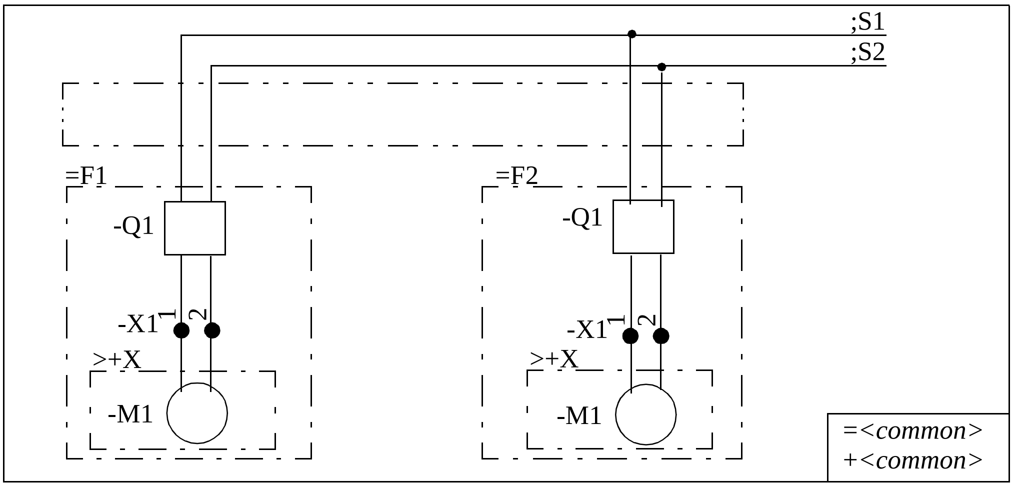


Figure D-13. Example for a diagram incl. only hierachicle reference designations

Appendix E 1 Workflow - Administration of Blocklibrary

E.1 Introduction

In addition to the **following documents**, this appendix describes the Workflow to create or modify symbols, symbol groups or symbol libraries.

The corresponding chapters in the referenced users manual and standards are:

- Related standard (IEC or DIN) - listed in Section 1.5, Related Documentation
- Users manual of elMaster design
  - Chapter 2, converting symbols
  - Chapter 4, Layers
  - Chapter 4, Symbols
  - Chapter 4, The symbol library (BLOCKLIB)
  - ...
  - **Chapter 6, Create your own block**
- **Electrical Diagram Builder - Building libraries** (This Document)
  - Appendix B, Structuring and Naming Conventions for Symbol Libraries
  - Appendix C, Guideline for Building Symbols
  - Appendix D, Guideline for Building Composed Symbols/Typical Diagrams

E.1.1 Background

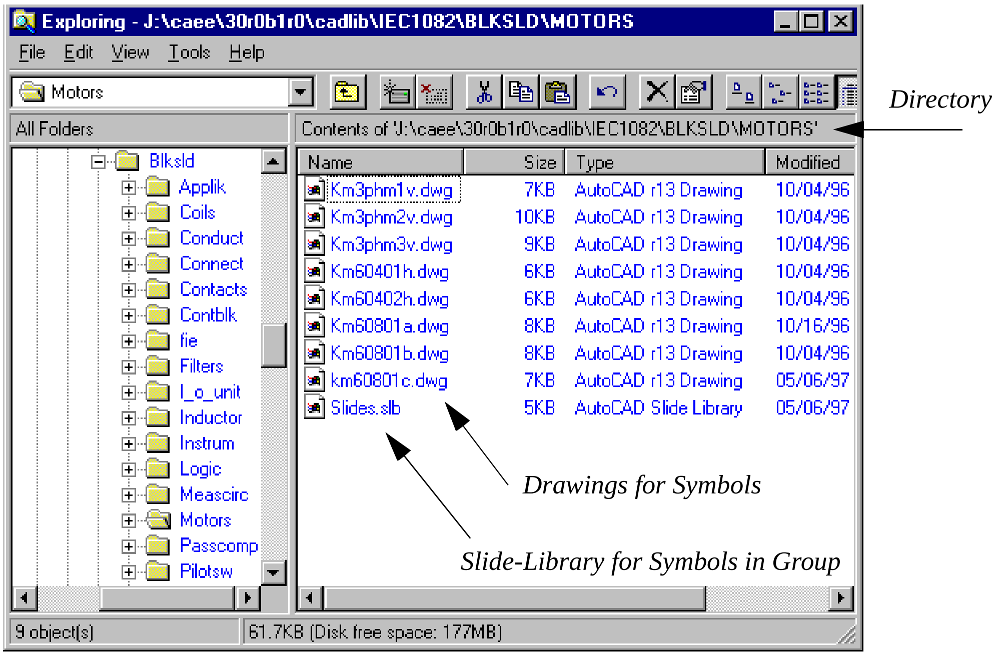
In symbol blocks, you can specify the following:

- Which static graphic symbols are included
- Which attribute definitions are related to the symbol
- Which connect nodes/connection points are related to the symbol.

The graphical representation is separated between different orientation views/variants corresponding to the rotations, in which the symbols can be used within circuit diagrams. If this is the same, symbols must be specified several times.

E.1.2 General Conventions

- Symbols are stored on the file system as AutoCAD files in *.dwg file format. File/directory in the integrated environment is: **...\cadlib\<symbollibrary>\blksld\<symbolgroup>\<symbolname>.dwg**
- In addition, the symbols are registered by elMaster design in an associated registration database **...\cadlib\bdb\blocklib.mdb**.



Exploring - J:\caee\30r0b1r0\cadlib\IEC1082\BLKSLD\MOTORS

Contents of 'J:\caee\30r0b1r0\cadlib\IEC1082\BLKSLD\MOTORS'

- Blksld
  - Applik
  - Coils
  - Conduct
  - Connect
  - Contacts
  - Contblk
  - fie
  - Filters
  - I_o_unit
  - Inductor
  - Instrum
  - Logic
  - Meascirc
  - Motors
  - Passcomp
  - Pilotsw

Name	Size	Type	Modified
Km3phm1v.dwg	7KB	AutoCAD r13 Drawing	10/04/96
Km3phm2v.dwg	10KB	AutoCAD r13 Drawing	10/04/96
Km3phm3v.dwg	9KB	AutoCAD r13 Drawing	10/04/96
Km60401h.dwg	6KB	AutoCAD r13 Drawing	10/04/96
Km60402h.dwg	6KB	AutoCAD r13 Drawing	10/04/96
Km60801a.dwg	8KB	AutoCAD r13 Drawing	10/16/96
Km60801b.dwg	8KB	AutoCAD r13 Drawing	10/04/96
km60801c.dwg	7KB	AutoCAD r13 Drawing	05/06/97
Slides.slb	5KB	AutoCAD Slide Library	05/06/97

9 object(s)

61.7KB (Disk free space: 177MB)

Directory

Drawings for Symbols

Slide-Library for Symbols in Group

Figure E-1. Example Symbol-Directory

E.1.3 Reference to Standards

The graphic part of conventional circuit diagram symbols according to IEC and DIN must be done according to [I2]. More complex symbols may be composed also by several elemental symbols.

Symbols specific to instrumentation and control according to DIN are also described in [D5].

Symbols specific to instrumentation and control according to ISO are also described in [S2].

Principles and rules according to ISO/IEC are described in [S5].

Principles and rules according to DIN are described in [D6] and [D2] T1000.

E.1.4 Graphical Design Principles

General design conventions:

For general and graphical conventions see Appendix C, Guideline for Building Symbols , for Circuit Diagram Symbols.

Recommendations:

1. It is recommended that you block graphical symbols before adding attributes.
2. The actual **drawing-template** for all elMaster activities is **...\Elmaster\Design\Msc\Elmaster.dwg**. If additional adjustments for symbol works are necessary, create your own drawing template (e.g. **...\Elmaster\Design\Msc\Elymbol.dwg**) and use this for symbol administrations.

E.1.5 Attribute Conventions.

Item Designation Attributes

See Appendix C, Guideline for Building Symbols, Section C.2.4, Attribute Definitions

Attributes for Cross-Reference handling,
Terminals

See Appendix C, Guideline for Building Symbols, Section C.2.3, Connection Point and Reference Point Definitions

Symbol-Category (corresponds CATEGORY_1 - only in Blockbuilder))
Object-Category

See Appendix C, Guideline for Building Symbols, Section C.2.5, Symbol Categories

For actual list of Symbol-Categories see Section E.3.2, List of elMaster Symbol-Categories.

The symbol category will be used to give the related object a corresponding **Object category** (DB-category). The default mapping is shown in Section E-1, List of elMaster Symbol-Categories

Symbol-Type (corresponds CATEGORY_2 - only in Blockbuilder))

See Appendix C, Guideline for Building Symbols, Section C.2.6, Symbol Types

E.2 Workflow Administration of Blocklibrary

E.2.1 Recommendations and Requirements

E.2.1.1 Analyzing of Symbols

The following part describes the steps and actions to define and create a new Symbol for CAEE usage.

The desired working with the symbols (also composed symbols) decides on the creation of a new symbol.

For more information about Symbol Types see
Appendix C, Guideline for Building Symbols / Section C.2.6, Symbol Types

Useful questions :

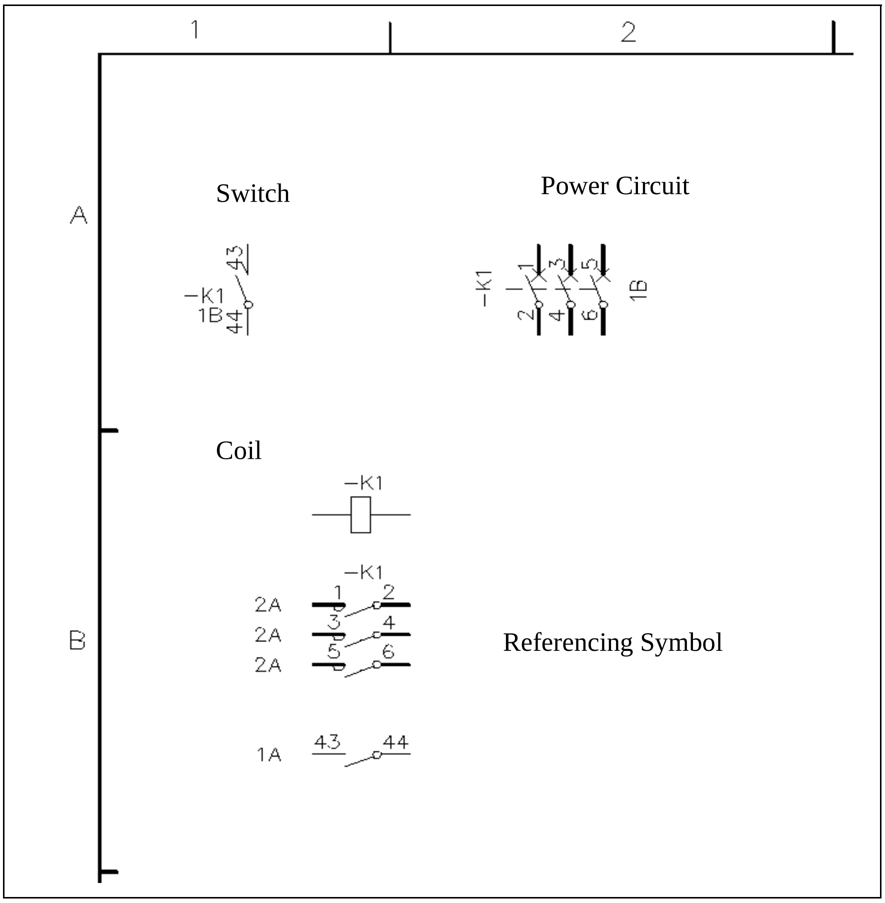
1. **Dividing into several symbol elements necessary ?**
   See also Detached Symbol according IEC1082-1 Chapter 2.1.3
   Methods of the Representation of Components and Connections in Diagrams :
   attached representation,
   semi-attached representation,
   detached representation and
   repeated representation.
2. Reference Symbol for Cross-reference Handling exist ?
3. Referencing Symbol exist ?
4. Which Symbol-Category (CATEGORY1) is to be used?
5. Symbol type (CATEGORY2) required ?

Important:

Use only **new and empty Drawing-Templates** - Old block-definitions can be disturb the creation of new blocks.

Example:

For example the **analysis** of the corresponding symbols to build a detached **Contactor** will be shown:



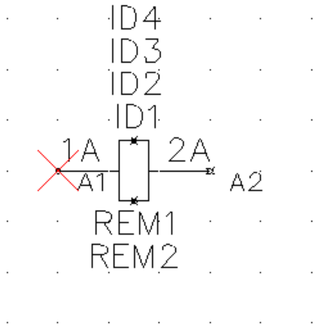
The Contactor is separated in the following symbols: **Coil,**

Power Circuit,

Switch,

Referencing Symbol.

1. **Analyze Symbol of type Coil**



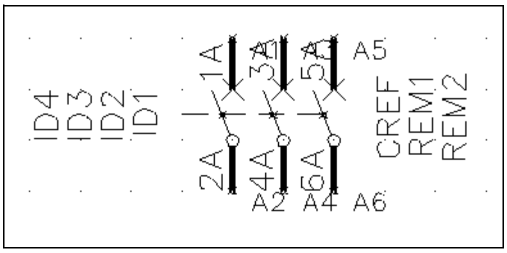
(For list of symbol types see manual elMaster design, chapter "Categories and types")

- Symbol type
  The **Coil** is a main symbol -
  Symbol type (CATEGORY2) = "**ED_MAIN**"
- Symbol-Category (CATEGORY1) = "**COIL**"

Attributes

- Designations (ID1-ID4)
  are used to reference the Main Symbol. The Database entry will be handled via designations.
- Terminals to be defined
  Actual state of elMaster design :
  Create the terminal tags numbers without gap. Otherwise, the referencing doesn't working well. The sequence A1, A2, A4 is not allowed.
  The max. number of terminals is 9/12. Twelve terminals can be created for one symbol, the input mask handles only nine terminals during insert or modification procedure of the symbol.
- Connection Points
  to be defined
- Cross-reference
  No cross-reference definition required, the main symbol will be referenced by designations (ID's)
- Remarks
  Define the Remarks for the total group of Contactor symbols only for main symbols with priority.
- Extra Attributes not required

2. **Analyze Symbol of type Power Circuit**



Categories

– Symbol type
Value not required, Symbol type (CATEGORY2) = “”

– Symbol-Category (CATEGORY1) = “**POW_CIRC**”

Attributes

– Designations (ID1-ID4)
Define the Designation attributes.
Usage of Designations is necessary. The Power Circuit will be referenced to the Main Symbol (Coil in our example) via Designation and CREF attribute.

– Terminals
To be defined. The number and numbering of Terminals for the Power Circuit Symbol and the corresponding Referencing Symbol (if exist) must be equal. See also the terminal description of the Main Symbol.

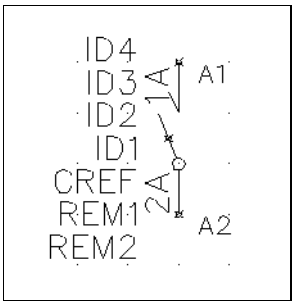
– Connection Points
to be defined

– Cross-reference
Cross-reference attribute CREF required, the Power Circuit will be referenced to the Main Symbol (Coil) by CREF attribute.

– Remarks
Define the Remark attributes.
Usage of Remarks only if is necessary (delete Remark attributes or switch they to a hidden layer - SOSED_CIRCUITOFF)

– Extra Attributes not required

3. Analyze Symbol of type Switch



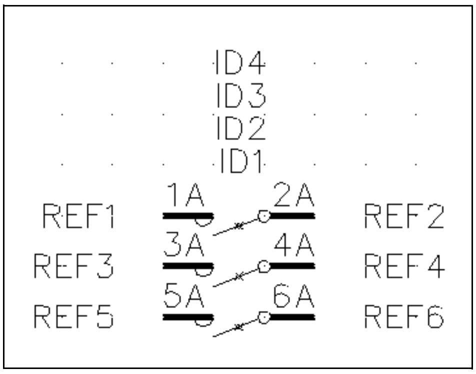
Categories

- Symbol type
  Value not required, Symbol type (CATEGORY2) = “”
- Symbol-Category (CATEGORY1) = “**NORMALLY_OPEN**”

Attributes

- Designations (ID1-ID4)
  Define the Designation attributes.
  Usage of Designations is necessary. The Power Circuit will be referenced to the Main Symbol (Coil in our example) via Designation and CREF attribute.
- Terminals
  To be defined. The number and numbering of Terminals for the Power Circuit Symbol and the corresponding Referencing Symbol (if exist) must be equal. See also the terminal description of the Main Symbol.
- Connection Points
  to be defined
- Cross-reference
  Cross-reference attribute CREF required, the Power Circuit will be referenced to the Main Symbol (Coil) by CREF attribute.
- Remarks
  Define the Remark attributes.
  Usage of Remarks only if is necessary (delete Remark attributes or switch they to a hidden layer - SOSED_CIRCUITOFF)
- Extra Attributes not required

4. Analyze Referencing Symbols



Categories

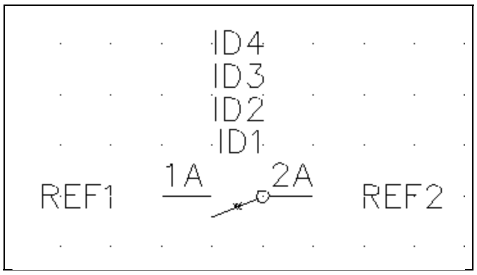
- Symbol type
  Symbol type (CATEGORY2) = "**ED_XBLK**" required
- Symbol-Category (CATEGORY1) = "**POW_CIRC**"
  Must be the same symbol category like the referenced symbol (Power Circuit)

Attributes

- Designations (ID1-ID4)
  Define the Designation attributes.
  Usage of Designations only if is necessary (delete Designation attributes or switch they to a hidden layer - SOSED_CIRCUITOFF)
- Connection Points
  to be defined
- Terminals
  To be defined. The number and numbering of Terminals for the Referencing Symbol and the corresponding Power Circuit Symbol must be equal.
- Cross-reference
  Not allowed.
- Remarks
  Define the Remark attributes.
  Usage of Remarks only if is necessary (delete Remark attributes or switch they to a hidden layer - SOSED_CIRCUITOFF)
- Extra Attributes - special use
  The Tag of Reference Attribute has to be named **REFx** (x = 1 ... n).

  To build the Reference Attributes use a created template or rename another attribute.

5. Analyze Referencing Symbol



Categories

– Symbol type
Symbol type (CATEGORY2) = "**ED_XBLK**" required

– Symbol-Category (CATEGORY1) = "**NORMALLY_OPEN**"
Must be the same symbol category like the Referencing symbol (Power Circuit)

Attributes

– see attributes of Referencing Symbol POW_CIRC (4.)

E.2.1.2 Construction of Symbols

needs experience in AutoCAD - Design like

- Using of Object Snap functions
- Scaling and Rotate
- Trim and Stretch
- Using of construction aids
- Using of special line types
Example:
Black rectangles, circles or arrows (filled with HATCH) will be constructed with a lot of lines (1900 lines for a circle of 2 mm diameter) and the performance is very low in all processing steps.
Recommendation:
Use the draw function **polylines** with the depending thickness for filled squares, rectangles and arrows and
use the draw **function "donut"** to build rings (with a inner diameter = 0) to construct filled circles.
The processing of the depending symbol will be faster (10-20 times).

E.2.2 Symbol Creation

1. Remember:
Analyze of Symbol to be created (description in Section E.2.1.1, Analyzing of Symbols

  - Standard, Designations, Remarks
  - Complexity
  - Categories
  - References
2. Creation (=Construction) of Symbols
  - as Graphical and/or
  - as Diagram Symbol
3. Test of Symbol by usage in a integrated Test-Drawing Environment (including Referencing and Connections)
4. Modification of BLOCK-Database and files for DB-Merging and Generation

E.2.2.1 Methods of Symbol Creation

There are three different methods to create a symbol:

1. Use the standard report function of e**lMaster design | Blocklib | Administration** to load the symbols do you want to work with.
2. Open a maintenance drawing containing the desired symbols.
3. During drawing works, a symbol can be created or modified and registered in the Blocklibrary.

The next chapter describes the method 1.

E.2.3 Range of elMaster-Design Operating Steps

During the creation of libraries iec11714 and iec617 the following range of operating steps is formed

1. Open the elMaster template drawing **elmaster.dwg** and check the basic configuration according grid, snap, layers, linesize and so on. If necessary, save your own template to create and modify symbols.

2. Call the elMaster Function **Blocklib | Admin** menu

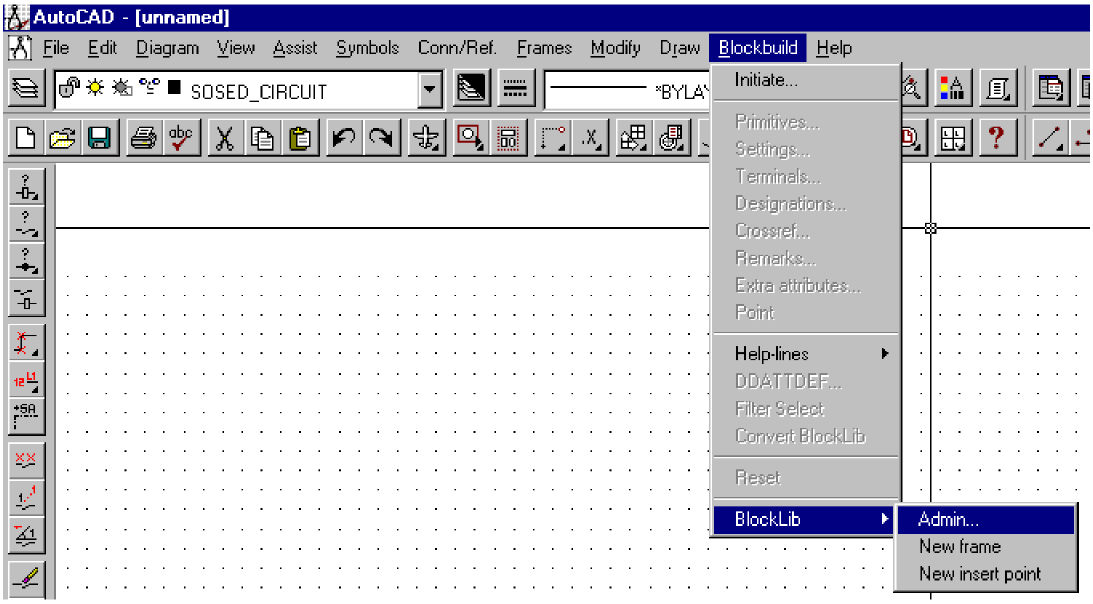
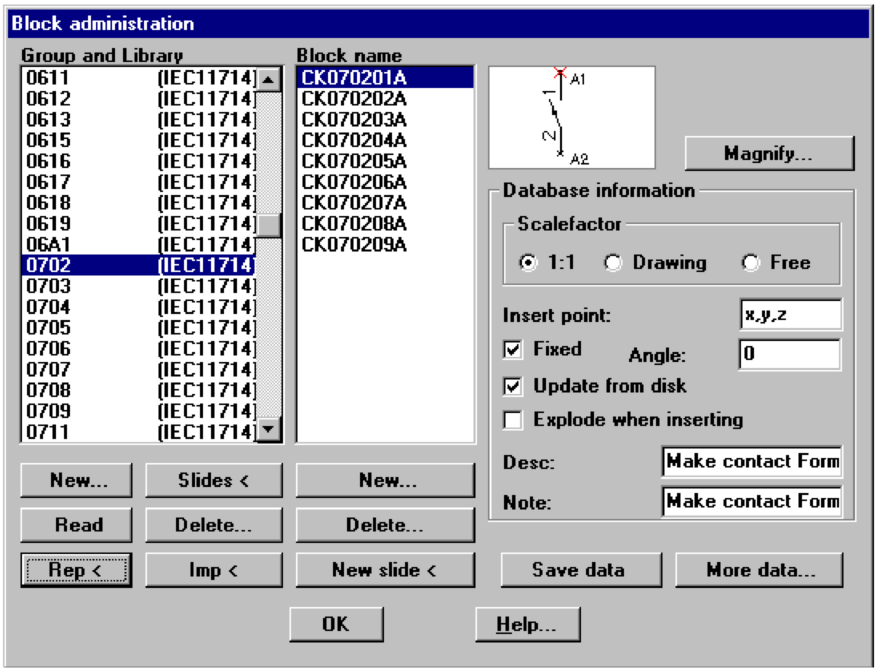


Figure E-2. Start of BlockBuild Administration

The Block Administration window is shown.:


Block administration

Group and Library

0611 (IEC11714)
0612 (IEC11714)
0613 (IEC11714)
0615 (IEC11714)
0616 (IEC11714)
0617 (IEC11714)
0618 (IEC11714)
0619 (IEC11714)
06A1 (IEC11714)
0702 (IEC11714)
0703 (IEC11714)
0704 (IEC11714)
0705 (IEC11714)
0706 (IEC11714)
0707 (IEC11714)
0708 (IEC11714)
0709 (IEC11714)
0711 (IEC11714)

Block name

CK070201A
CK070202A
CK070203A
CK070204A
CK070205A
CK070206A
CK070207A
CK070208A
CK070209A

Database information

Scalefactor: ● 1:1 ○ Drawing ○ Free

Insert point: x,y,z

☑ Fixed Angle: 0

☑ Update from disk

☐ Explode when inserting

Desc: Make contact Form

Note: Make contact Form

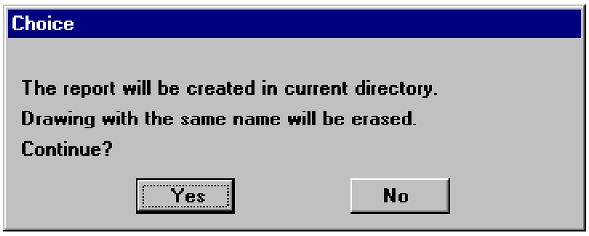
Figure E-3. Block Administration

Select the desired library-group and report the symbols - **function Rep<** (Read the symbols into the actual empty drawing)

or create a new group - **function New...** .

NOTE

Remember the name of the symbol group - you will need it later on !


Choice

The report will be created in current directory.
Drawing with the same name will be erased.
Continue?

Figure E-4. Block Report choice question

Click **Yes**.

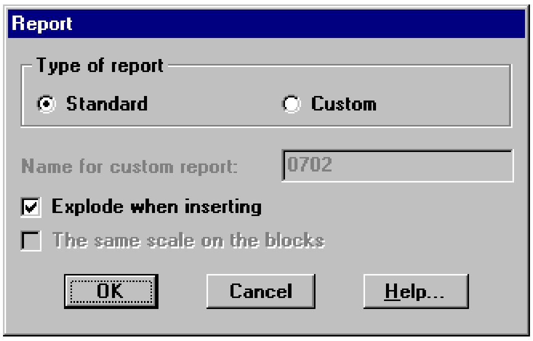


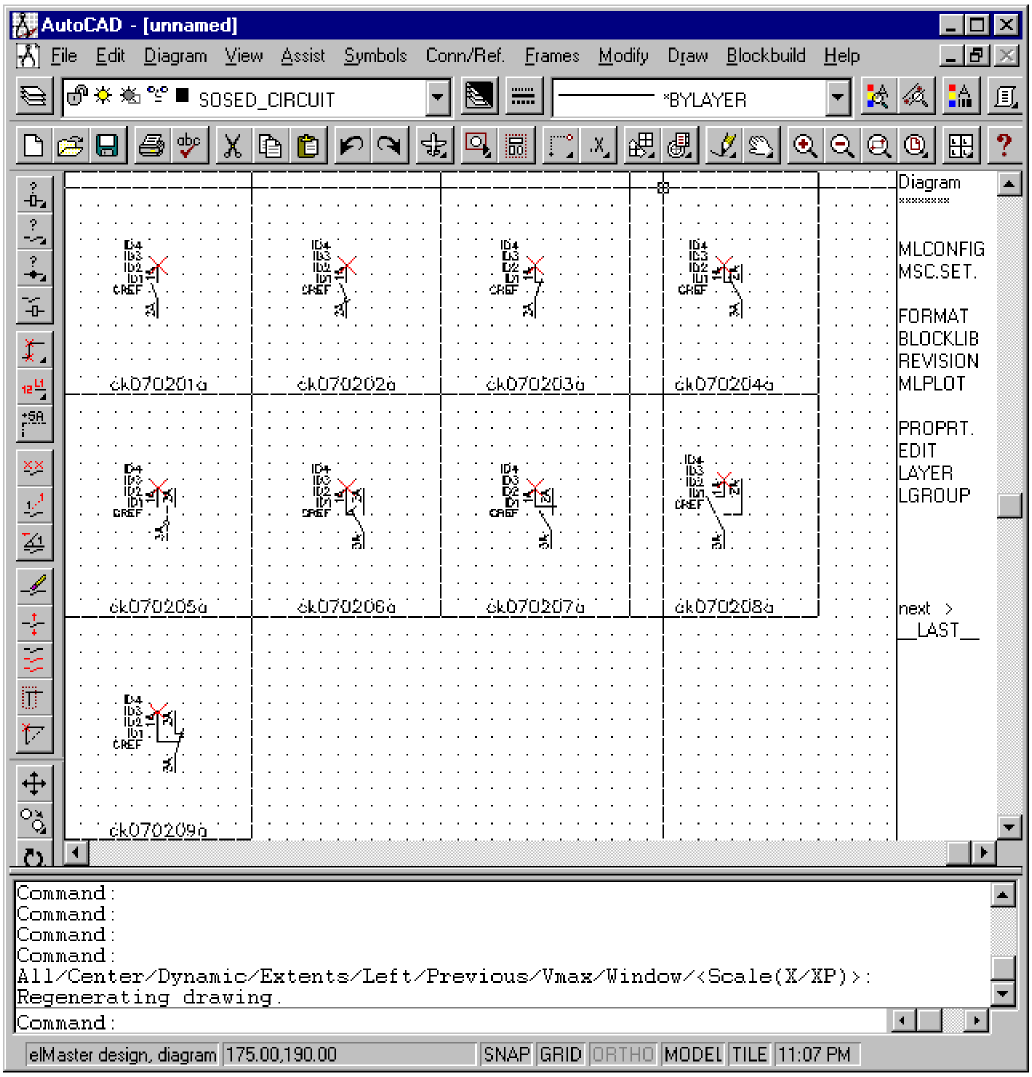
Figure E-5. Question - Type of Report

3. Select **Standard** for the **Type of Report** and **Explode when inserting** and Click **OK** to report the symbols

4. The Block Administration window will be shown (like Figure E-3 Block Administration.

   Leave the Block Administration menu (Click **OK**).

5. The Drawing containing the reported symbols is now active. (see next page)



```
Command:
Command:
Command:
Command:
All/Center/Dynamic/Extents/Left/Previous/Vmax/Window/<Scale(X/XP)>:
Regenerating drawing.
Command:
```

elMaster design, diagram | 175.00,190.00 | SNAP | GRID | ORTHO | MODEL | TILE | 11:07 PM

Figure E-6. Drawing of Blockbuild Report

The exploded symbol blocks of the selected group are shown in the current drawing.

Call the menu item **Blockbuild** and

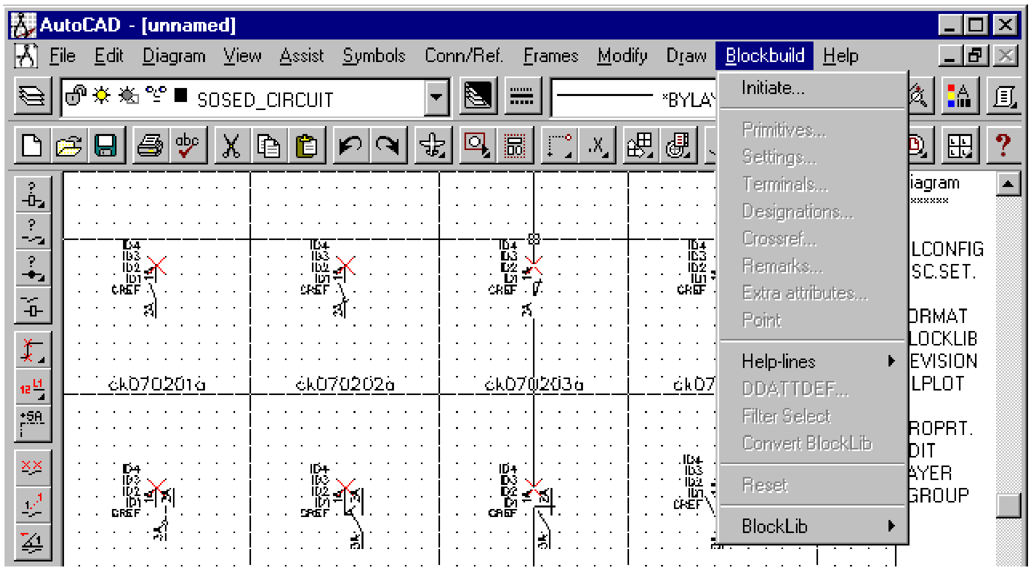


Figure E-7. Activate Blockbuild Initiate

Activate the function **Blockbuild | Initiate**

- to show all attributes (also the terminals) and
- to switch to **layer 0** and
- activate the attribute functions

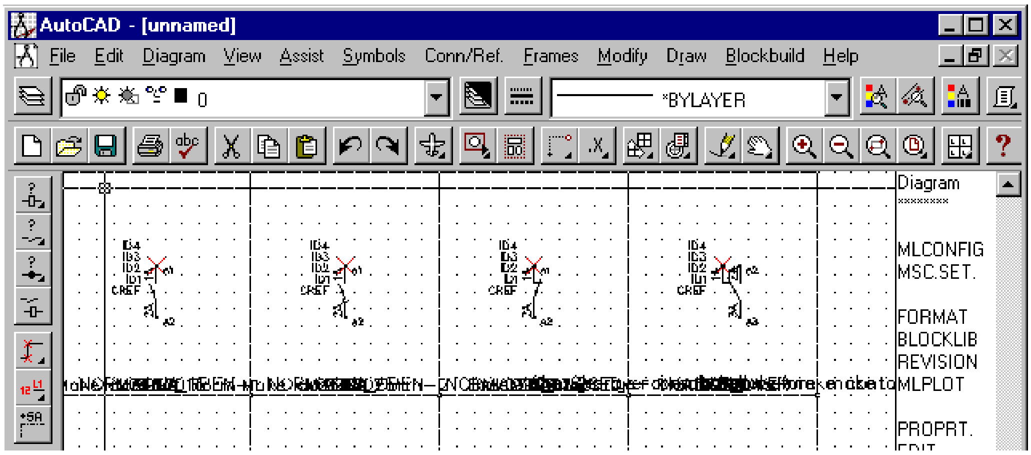
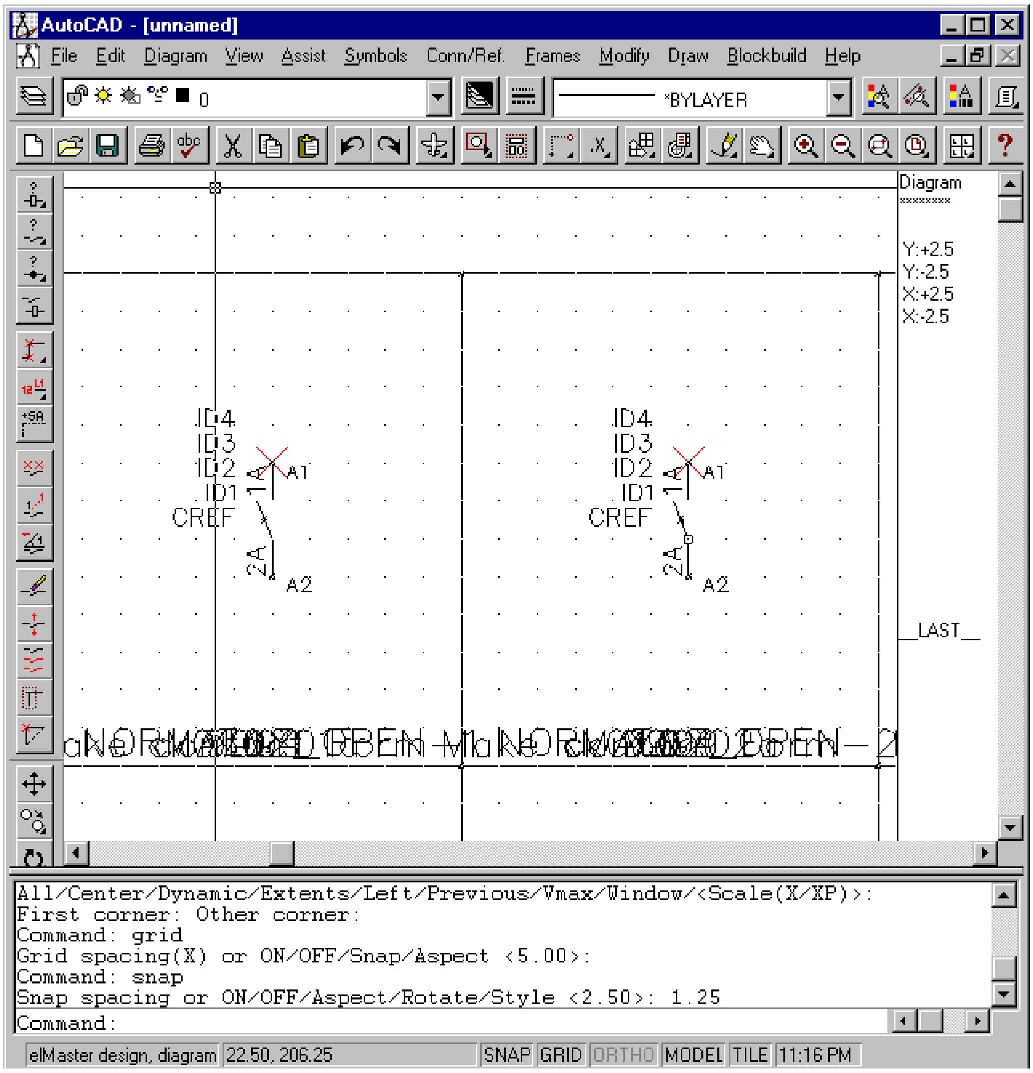


Figure E-8. Blockbuild initiated

Choose an useful Zoom-factor



```
All/Center/Dynamic/Extents/Left/Previous/Vmax/Window/<Scale(X/XP)>:
First corner: Other corner:
Command: grid
Grid spacing(X) or ON/OFF/Snap/Aspect <5.00>:
Command: snap
Snap spacing or ON/OFF/Aspect/Rotate/Style <2.50>: 1.25
Command:
```

elMaster design, diagram | 22.50, 206.25 | SNAP | GRID | ORTHO | MODEL | TILE | 11:16 PM

Figure E-9. Grid and snap spacing

and define our own **grid** spacing (5.0 or 2.5) and **snap** spacing (1.25 or 0.625 is recommended).

6. **Modify and / or create your symbols** according the elMaster design User’s Manual - Chapter 4, Administration of symbols

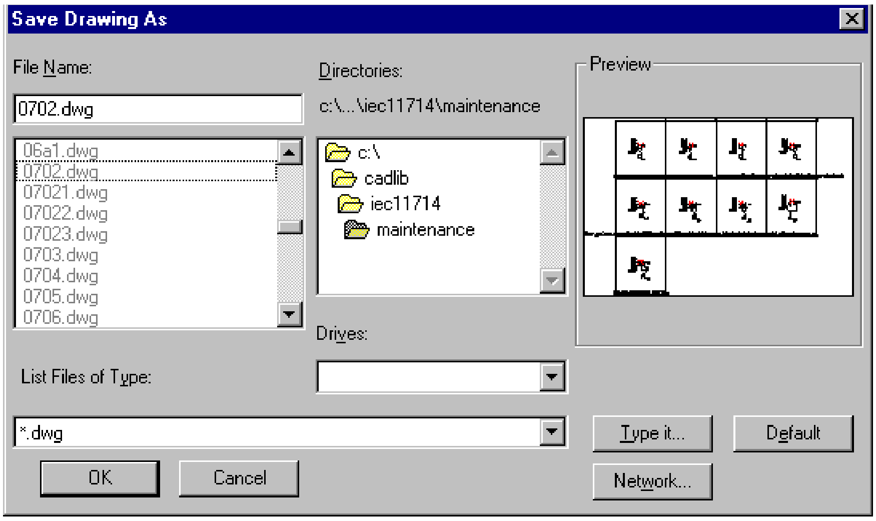
   Remember related documents and standards:

   Appendix C, Guideline for Building Symbols of this document

   Actions:

   - Create or import the graphic of the symbol
   - Place the Insertion Point
   - Insert the Terminals, check (and correct) the position and the alignments of the terminal text.
   - Insert the Designations (position and alignments)
   - Insert the References (for Cross-references), if required
   - Insert the Remarks, if required

7. After Block/Symbol-modifications or -creations, continue the workflow with **save** the actual drawing (<group_name>.dwg) as a working-drawing to protect the group session works and/or a maintenance-drawing to prepare further imports.



Save Drawing As

File Name: 0702.dwg

Directories: c:\...\iec11714\maintenance

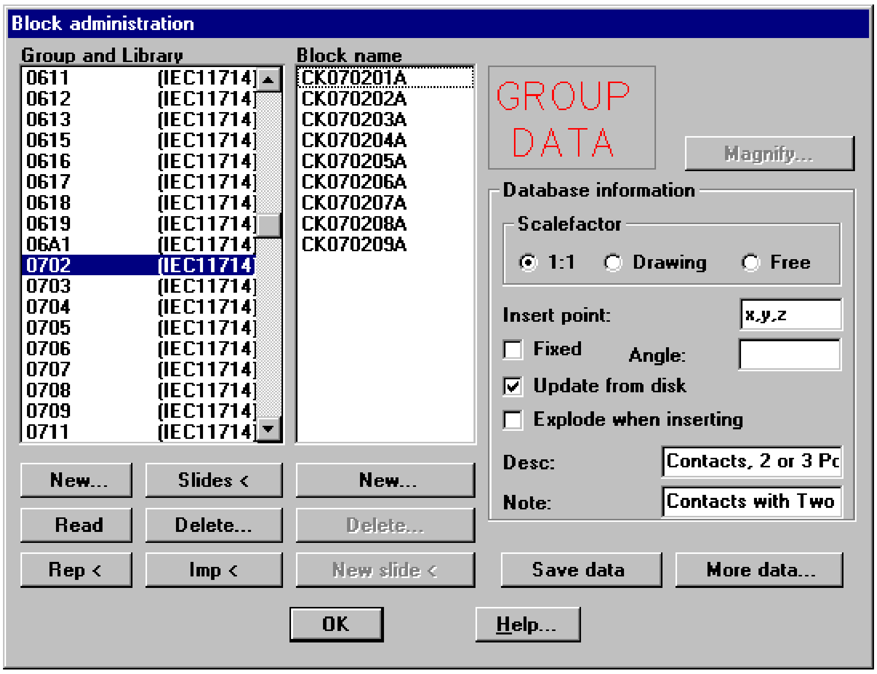
List Files of Type: *.dwg

Figure E-10. Save the actual report

Define the directory and the name of the desired file and click **OK**.

8. Call the elMaster Function **Blocklib Admin** menu again and write back (import) your modifications - **function imp**.
   This function saves the symbol blocks <symbol>.dwg in the corresponding directory and updates the Database entries in the Block Library.

.



Database information

Scalefactor: ● 1:1 ○ Drawing ○ Free

Insert point: x,y,z

☐ Fixed Angle:

☑ Update from disk

☐ Explode when inserting

Desc: Contacts, 2 or 3 Pc

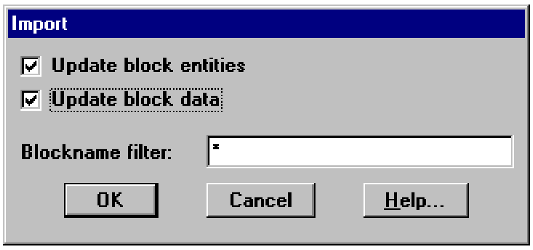
Note: Contacts with Two

Figure E-11. Block administration to save the modifications

Requirements:

a. Set the Insertion **Scalefactor** = **1:1**

b. Set the **insertion-point to x,y,z** and the **angle** to **fix** and = **0°**.
(Angle 0° will be interpreted like angle not filled in if 'Fixed' is not selected)



☑ Update block entities

☑ Update block data

Blockname filter: *

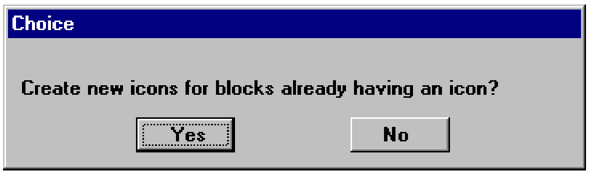
Figure E-12. Update options

Select both possibilities to save the symbol blocks <symbol>.dwg in the corresponding directory and update the Database entries in the Block Library

click **OK** to continue.

9. Create a new version of slides for further use.

.



Create new icons for blocks already having an icon?

Figure E-13. Create new Slides

10. Open a new empty drawing by loading the template drawing. (See step 1)

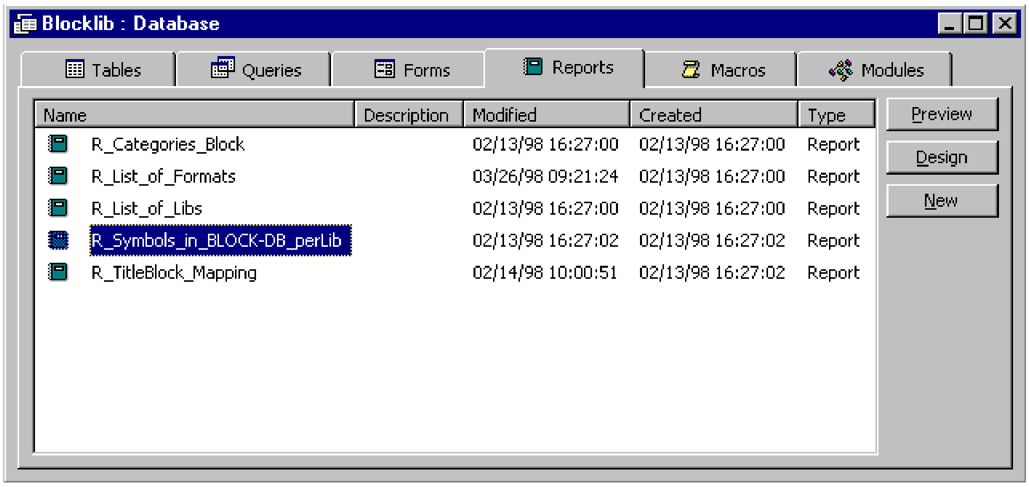
E.3 Symbol Reports

E.3.1 Symbol Lists and Checks

To list or check the symbol administration works, some reports are build in the Libraries database **...\cadlib\bdb\blocklib.mdb**

- **R_Symbols_in_BLOCK-DB_perLib**

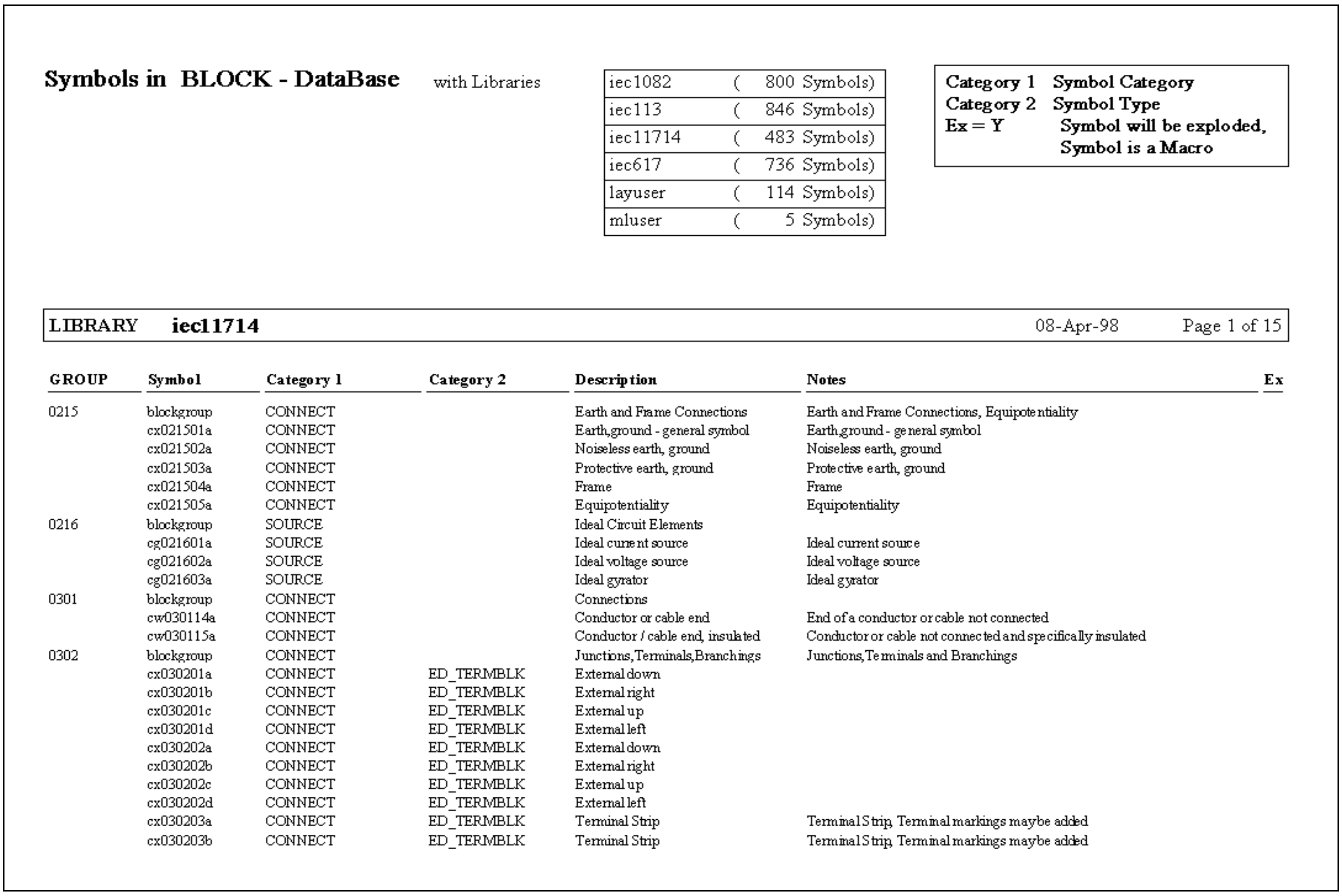
  The report lists all symbols containing in the selected library (e.g. iec11714)



Name	Description	Modified	Created	Type
R_Categories_Block		02/13/98 16:27:00	02/13/98 16:27:00	Report
R_List_of_Formats		03/26/98 09:21:24	02/13/98 16:27:00	Report
R_List_of_Libs		02/13/98 16:27:00	02/13/98 16:27:00	Report
R_Symbols_in_BLOCK-DB_perLib		02/13/98 16:27:02	02/13/98 16:27:02	Report
R_TitleBlock_Mapping		02/14/98 10:00:51	02/13/98 16:27:02	Report

Figure E-14. Activate the Report List_of_Symbols

- **R_Categories_Block**
  The report selects the actual state of used symbol categories.



Symbols in BLOCK - DataBase with Libraries

iec1082	(800 Symbols)
iec113	(846 Symbols)
iec11714	(483 Symbols)
iec617	(736 Symbols)
layuser	(114 Symbols)
mluser	(5 Symbols)

Category 1 **Symbol Category**
Category 2 **Symbol Type**
Ex = Y **Symbol will be exploded,**
Symbol is a Macro

LIBRARY **iec11714** 08-Apr-98 Page 1 of 15

GROUP	Symbol	Category 1	Category 2	Description	Notes	Ex
0215	blockgroup	CONNECT		Earth and Frame Connections	Earth and Frame Connections, Equipotentiality	
	cx021501a	CONNECT		Earth,ground - general symbol	Earth,ground - general symbol	
	cx021502a	CONNECT		Noiseless earth, ground	Noiseless earth, ground	
	cx021503a	CONNECT		Protective earth, ground	Protective earth, ground	
	cx021504a	CONNECT		Frame	Frame	
	cx021505a	CONNECT		Equipotentiality	Equipotentiality	
0216	blockgroup	SOURCE		Ideal Circuit Elements		
	cg021601a	SOURCE		Ideal current source	Ideal current source	
	cg021602a	SOURCE		Ideal voltage source	Ideal voltage source	
	cg021603a	SOURCE		Ideal gyrator	Ideal gyrator	
0301	blockgroup	CONNECT		Connections		
	cw030114a	CONNECT		Conductor or cable end	End of a conductor or cable not connected	
	cw030115a	CONNECT		Conductor / cable end, insulated	Conductor or cable not connected and specifically insulated	
0302	blockgroup	CONNECT		Junctions,Terminals,Branchings	Junctions,Terminals and Branchings	
	cx030201a	CONNECT	ED_TERMBLK	External down		
	cx030201b	CONNECT	ED_TERMBLK	External right		
	cx030201c	CONNECT	ED_TERMBLK	External up		
	cx030201d	CONNECT	ED_TERMBLK	External left		
	cx030202a	CONNECT	ED_TERMBLK	External down		
	cx030202b	CONNECT	ED_TERMBLK	External right		
	cx030202c	CONNECT	ED_TERMBLK	External up		
	cx030202d	CONNECT	ED_TERMBLK	External left		
	cx030203a	CONNECT	ED_TERMBLK	Terminal Strip	Terminal Strip, Terminal markings maybe added	
	cx030203b	CONNECT	ED_TERMBLK	Terminal Strip	Terminal Strip, Terminal markings maybe added	

Figure E-15. Result of Report List_of_Symbols

E.3.2 List of elMaster Symbol-Categories

)

Table E-1. CAD_Categories, used in the Actual Symbol Database

CAD_CATEGORY2	**preferred DB_CATEGORY2**
2-WAY	RELAY
CABLE	
CAPACITOR	CAPACITOR
CHANGE_OVER	RELAY
CLOCKS	
COIL	RELAY
CONNECT	CONN_UNIT
CONTACT	
CONTROLLER	
COUNTING_DEV	
CRYSTALS	
DELAY_LINES	
FERRITE_CORE	
FILTER	FILTER
I/O_CHANNEL	IO_CHANNEL
INDUCTOR	HIGH_VOLT_DEV
INSTRUMENT	INSTRUMENT
MECH_CONTROL	
MISC	
MOTOR	MOTOR
NORMALLY_CLOSED	RELAY
NORMALLY_OPEN	RELAY
OPERATING_DEV	
PILOTSW	PILOT_SWITCH
POW_CIRC	CIRCUIT_BREAKER
PROTECT	FUSE
QUALIFYING	
RELAYS	
RESISTOR	RESISTOR
SEMICOND	HIGH_VOLT_DEV

Table E-1. CAD_Categories, used in the Actual Symbol Database

CAD_CATEGORY2	**preferred DB_CATEGORY2**
SENSOR	TRANSMITTER
SIGNAL	SIGNAL_DEV
SOURCE	POWER_SUPPL
SWITCH	CONTROL_SWITCH
THERMOCOUPLE	
TRANSDUC	TRANSDUCER
TRANSFORM	TRANSFORMER
WINDINGS	

3BDS001710R0101

July 1998